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OCTOBER 17, 1935

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What Are You Willing To Pay?

EVERYONE who has anything pays tax, because taxes are either collected from, or passed on to, all who receive income and all who spend. A recent striking example of hidden indirect taxation is the processing tax on meat, grains and cotton. The government is paid by the processor, but actually the tax is paid by the customer. Now we get only two pork chops for the price which formerly bought three. The government has taken the third chop to the extent that the processing tax has increased the cost.

Normally, about 50,000,000 people are gainfully employed in the United States in private industry, business and agriculture. Various estimates place those still unemployed in private pursuits, at 10,000,000. If these estimates are correct, 40,000,000, or 80 per cent, are employed. These gainfully-employed receive more that four-fifths of the national income, so that it is they—the 40,000,000—they and their families—who carry most of the tax load.

The present rate of taxation cannot be taken as a basis for estimating what the load will be in the future. Additional taxes will be required to pay expense already incurred, and no one can guess what the next Congress will spend. As the last Congress failed, by billions of dollars, to provide the taxes necessary to cover appropriations, sufficient taxes must be levied later unless, by repudiation or currency inflation, the government fails to pay what it has borrowed as government bonds and notes. These taxes must bear heavily on the 40,000,000 who pay. The four billion dollar relief bill alone is $100.00 for each of the 40,000,000. If it is true that the last Congress appropriated ten billion dollars, the 40,000,000 will pay at the rate of $250.00 each.

It is not suggested that, to avoid taxes and payments from wealth, we have no government. It is not suggested that we have no army or navy. It is not suggested that we fail to give adequate relief to those in need. It is suggested, however, that every individual who has a job and who has property, and, therefore, who pays, review what the government has done and plans to do.

As one of the 40,000,000 who pay, you should tell your congressmen, state legislators and local officials how much of your wealth you want them to spend . . . whether you want government expenditures increased or decreased.

George P. Torrence

President, Link-Belt Co.

Identification of the Lindbergh

MUCH has been written and heard about the wood in the Lindbergh ladder. But practically nothing has been said about the 44 nails that held it together. Yet these nails were identified with uncanny positiveness through the research of the author, Stanley R. Keith.

His testimony for the State of New Jersey was not presented at the trial of Bruno Hauptmann, because the collapse of the defense alibis made quick closing desirable to the prosecution. Here, for the first time, is presented, with the consent of Attorney General Wilentz, a most interesting story of identification which traces the ladder nails directly back to the nail keg in Hauptmann's garage.

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IN attempting to give an accurate résumé of the technological phase of the investigation of the nails in the ladder used in the kidnapping of the Lindbergh baby, the author is confronted with the necessity of giving precedence, in an article of this nature, to the technical considerations involved.

The opinion that the 44 8d. common wire nails used in the assembly of the 11 rungs to the side members, were components of the original contents of the keg found to have been partly used by Hauptmann in constructing his garage, as an inescapable conclusion is one thing; the laborious citation of detailed circumstances, one by one, leading up to this point is quite another.

To the ordinary layman, nails are nails, in the absence of any positive occasion to regard them otherwise. Any references to further characterizations are apt to be construed as theoretical. Nor does the carpenter's practical contact with them serve to develop a correspondingly more intimate knowledge of nails except for type and size.

It is interesting to contrast the criminal's well defined respect for finger-print evidence in contradistinction to the highly systematic technology overlooked in the nails. The striking analogy will become more and more apparent when we regard the grip marks left on the wire by the chucking dies to be parallel in effect to grasping an article with the thumb and forefinger.

However, the impression that "nails are nails" and hence without individuality is a prevailing one. Even the nail producer considered it hopeless to identify these ladder nails with the criminal, because of their utter promiscuity in the raw material and handling phases of the production, and of the overwhelming numerical factor involved in an annual marketing during the previous year 1931 of almost eight million kegs of wire nails, 25 per cent of which were of the specific type and size found in the ladder. This means a field increment annually of 200,000,000 lb. of such nails, or as units, 20,000,000,000 items of this class!

As a basic similarity, all the ladder nails were observed to bear the letter P on the obverse side directly below the head and just above the grips, as shown in Fig. 1, which is made up of a series of macrographs subsequently reduced in rephotographing for publication. The significance of this index letter P as a trade mark became at once obvious, as a means of fixing their mill source. Steel being synonymous with Pennsylvania, and more specifically Pittsburgh, a prompt reference to a directory disclosed the fact that the nail mill of the Pittsburgh Steel Co. is located at Monessen, Pa. This plant produced approximately 10 per cent of all the nails of this type and size marketed during 1931, thus serving as a detail, to reduce the field from 2,000,000 kegs to 200,000 kegs. This was by far too general to be of much help as an independent circumstance.

While all these ladder nails were similar in respect of their common letter P, they fell systematically within eight characteristic grip mark types, as the first sub-classification, viz: E S T V A U G H. The numerals within the parentheses beneath each such grip mark type so designated, show the number of ladder nails constituting such group values.

Even a cursory observation of the series will serve to refute the lay impression that nails are nails, constituting as they do the actual ladder nails themselves. Thus singled out, they are as distinctive in die-type as humans in individuality. A series of 100 specimens provided definitely from different assemblies while in production, for such a study, through the cooperation of J. N. Reese at the Monessen plant of the Pittsburgh Steel Co., showed no two alike after

Ladder Nails ▲ ▲ ▲

By STANLEY R. KEITH
Metallurgical Engineer, Montclair, N.J.
Steel Technologist for the State in the Hauptmann Trial

STANLEY R. KEITH, who made the investigation of the nails in the Lindbergh ladder for the State of New Jersey. He is with the A. P. Smith Mfg. Co., East Orange, N. J. Mr. Keith is a graduate of Lehigh, a former metallographist of Bethlehem Steel and later was in charge of metallurgical research for that company.

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a painstaking study by the author, and incidentally approximately 5000 involved comparisons. While this study was advisable from a lego-technical standpoint, the conclusion was also obvious on the basis of mechanical experience. For no die maker can duplicate his own handiwork in absolute detail.

"Personalities" of the Ladder Nails

Returning to the more detailed comparison of the macrophotographic series of Fig. 1:

Type E: Flattened loop section of the P, which in extending downward, tends to shorten the stem. The three upper barbings curve upward at their extreme right, while the rest terminate horizontally.

Type S: Relatively new die, the P is well defined and normal in typographic form. All eight barbings are so clearly defined as to be distinctive in themselves as a whole. The sharp upward termination to the right, of the third and fourth barbings, and the characteristic horizontal wrinkle or fold in all but the first two, serve to distinguish this type further.

Type T: The flattened loop section of this P, while extending downward, does not tend to shorten the stem which is broad in contrast to that of E. The eight barbings show extended production by this die assembly, and are characterized by a common declination to the right below horizontal.

Type V: Letter P of an appreciably larger size, and located farther below the head than the others. The barbings are so distinctive in their hooked contours, that this type is at once distinguished from all the rest.

Type A: The letter P declines to the right slightly from vertical, and is so badly emaciated typographically as to distinguish it at once. Overworked barbings show extended breakdown of die. Curious moon face form of the fifth and sixth barbings, respectively outlining the eyes and mouth.

Type U. Here the loop of P is deficient in its upper section, obviously resulting from the use of a broken stencil in stamping the die. Head is particularly thin, and there are characteristically wide bars between the second and third, and between the third and fourth barbings.

Type G: The stem of the P is quite pointed. The barbings are singularly horizontal, with well rounded extremities at the right. The head is thin.

Type H: The letter P declines appreciably from vertical to the right, with a broad and singularly oblique terminating stem. Its barbings generally resemble those in S but with convex curvatures of the first S, while the sixth and seventh barbings have singularly lipped sections.

With this classification of the ladder nails taken as a basic starting point, the problem resolved itself into a research of Hauptmann's normal nail contacts with a view toward the possible paralleling of these overwhelmingly singular features, in his work-a-day world.

Hauptmann's Nail Keg

Among his personal effects brought to State police headquarters there was included an ordinary nail keg with the head removed, except for a small segment having three letters in red stamped thereon, as part of a word terminating with E C T. This keg contained a remainder of 42 8d. common wire nails of the same size and type found in the ladder. They all bore the common symbol P, indicating the same mill source as those of the ladder.

In this connection, it was subsequently established, when this keg was taken personally to the Pittsburgh Steel Co., that the segment letters were part of the word PERFECT, and a careful comparison of their typographic details clearly showed them to have been stamped by the same die as that used at Monessen in the preparation of their keg heads. These keg nails were thus established as the obvious balance from the original keg lot, without reference at this point specifically to the ladder nails.

A painstaking examination and classification one by one, of these keg nails was made with recorded results as shown in Fig. 2. They were found to be identical in the

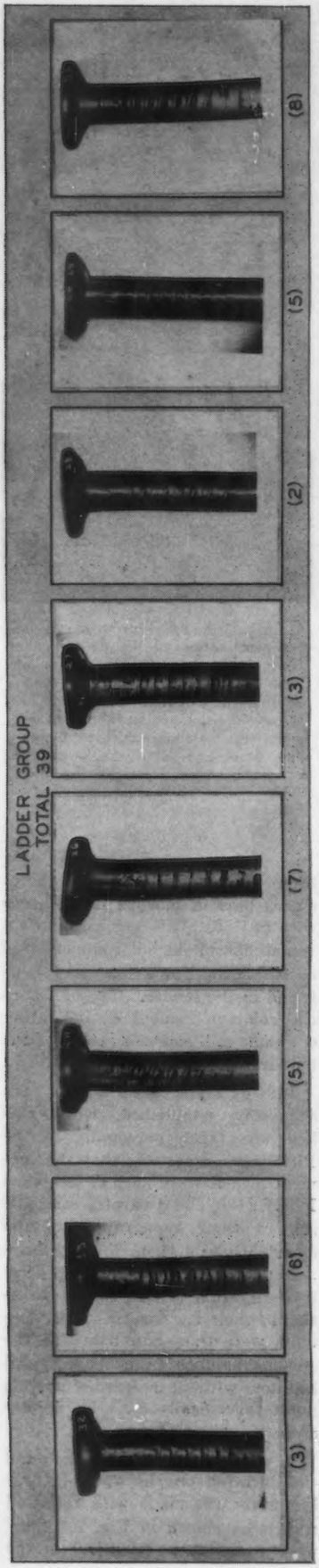


FIG. 1—Macrographs showing the various peculiarities of the ladder nails, caused by the die grip marks.

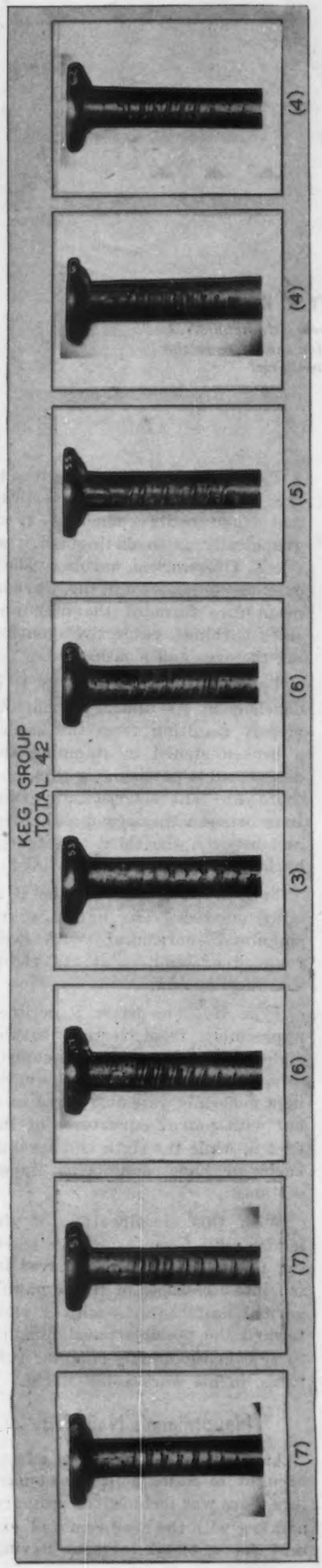


FIG. 2—Macrographs of the nails found in Hauptmann's nail keg.

minutest detail, type for type, with those of the ladder group; and in multiples as shown in parentheses underneath.

Further research among Hauptmann's miscellaneous effects offered 10 additional units, four of which were removed by the writer from a pair of his overalls. Their investigation, as shown in part recorded by Fig. 3, disclosed five of the total of eight die types, viz.: E S V U and H, and in multiples within the parentheses underneath.

Nails From Hauptmann's Garage

Extending this research still further in order to evaluate the quantity factor involved herein by the original keg's status, what would be more apt than to investigate the nails used by Hauptmann in the construction of his garage some time during the fall preceding the kidnapping? Such a normal nail demand would account for a large proportion of the keg's original contents, and from a reasonably sized recovery there could be established the group characteristics of these nails as packed at Monessen.

Unfortunately, the garage structure had been wrecked during the early stages of the search for additional ransom money, but detective Bornman recalled on questioning that a considerably sized heap had been knocked out of the lumber by him in recovering the boards for investigation purposes. Accordingly, 275 units were recovered from this spot by respading and sieving the ground. They were naturally covered with rust, but special chemical means were developed to clean them with a minimum amount of wear and tear on the grip markings. The result of their investigation are shown in part as recorded in Fig. 4. As anticipated, they too coincided precisely with the previous groups, type for type, and without exception.

In order to proceed with the final phase of this investigation, the keg was logically taken as the legitimate source of supply for Hauptmann's normal nail demands purely within the innocent province of his calling as a carpenter. Accepted as such, and without reference to the ladder group for the present, all the other nails were figuratively returned to their known original keg and the resultant numerical strength thereby attained, made the basis for further extended analysis

of their common 8 die-type status, into coil entities as the ultimate sub-division of their unit characteristics, and for the more subtle group characteristics which ensue.

Wire Coil Identities

Careful micrometer measurements for diameter and length, and accurate gravimetric determinations by the use of an analytical balance, together with an observantly constructive microscopic examination of each of these nails subjectively treated as units with respect to their wire drawn characteristics, constituted the detailed work necessary to assign the values given in Fig. 5, as indices of these technological details possessed by the lot in the premises. The coils fed to each of the respective die assemblies were thus revealed. By way of interpretation, it is worthy of note that the length is a function of the die assembly adjustment, and is the same within each die type, irrespective of the coil used. The diameters, as functions of the wire drawing die, were particularly interesting in that they disclosed the ellipticities common to each. The weights, being a function of both the wire drawing die's orifice and the machine assembly die's adjustment, tend to show consistently the effect within each die type of the variations in diameter. The fidelity with which, without exception, each unit revealed its coil characteristics, was surprising. Coil No. 11, having a double pick up, showed in unit after unit, for example, the two microscopic channels or grooves always equidistant, and always diverging at the same angle on the head and terminating precisely at the same location in the facet of the pointed end; while coil No. 12, when magnified sufficiently, showed its broad channel or groove to have the same characteristic contour and depth in all the specimens alike thus confirming the fixed form of the accumulated metallic die particle generating this defect as the common cause for each.

The group characteristics of this combined sample of 320 units accordingly reflect those of the technological lot from which they were packed, and it is the size of this packed lot that determines the final limit to which these ladder nails may be restricted as an inverse function of their criminological value.

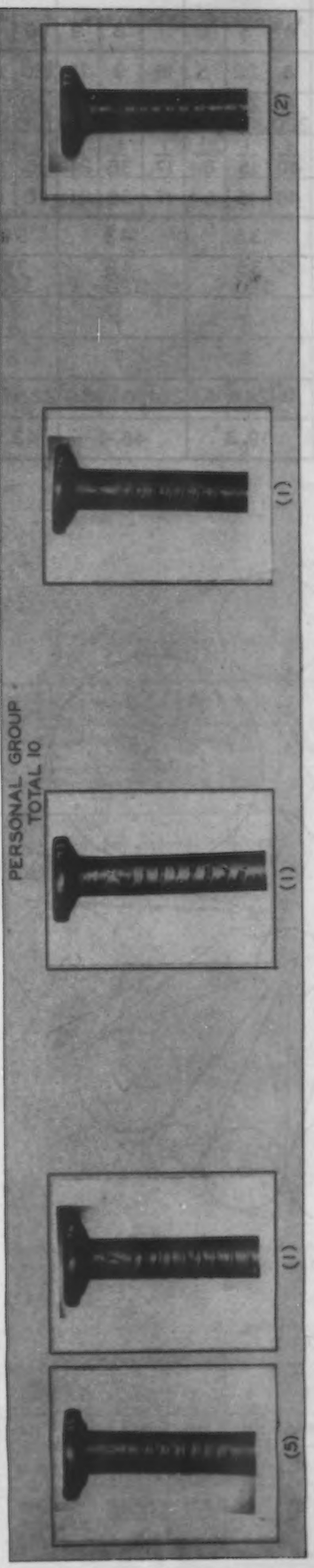


FIG. 3—Macrographs of nails found in Hauptmann's overalls.

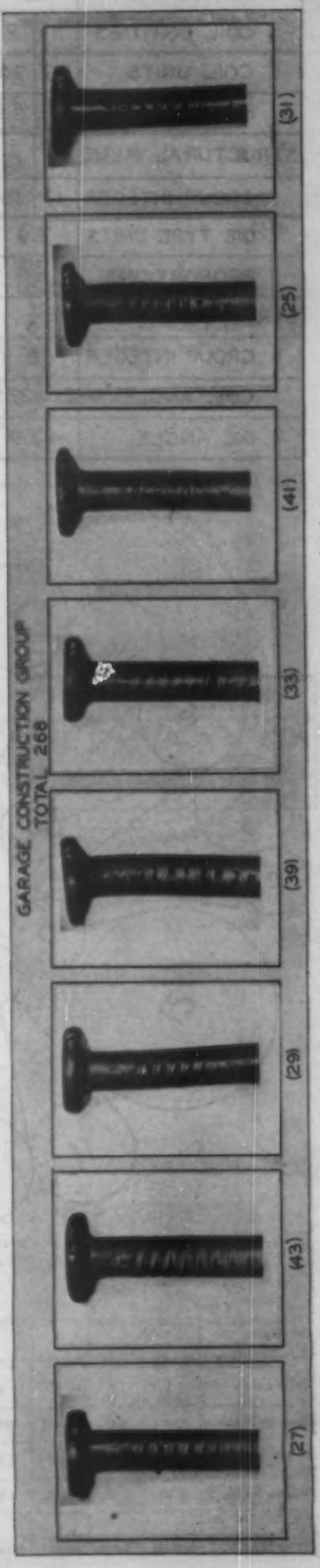


FIG. 4—Macrographs of nails used in Hauptmann's garage structure.

DIE TYPES	E		S	T			V			A		U	G		H		TOTAL 8
COIL ENTITIES	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	#16	16
COIL UNITS	19	20	51	8	22	5	19	9	15	20	19	47	11	18	19	18	320
PROPORTIONS	19/320	20/320	51/320	8/320	22/320	5/320	19/320	9/320	15/320	20/320	19/320	47/320	11/320	18/320	19/320	18/320	1
STRUCTURAL VALUE	1/17	1/16	1/6	1/40	1/15	1/64	1/17	1/36	1/21	1/16	1/17	1/7	1/29	1/18	1/17	1/18	1
GROUP INTEGER	17	16	6	40	15	64	17	36	21	16	17	7	29	18	17	18	AVERAGE
DIE TYPE UNITS	39		51	35			43			39		47	29		37		8
PROPORTIONS	39/320		51/320	35/320			43/320			39/320		47/320	29/320		37/320		1
STRUCTURAL VALUE	1/8		1/6	1/8			1/7			1/8		1/7	1/11		1/9		1
GROUP INTEGER	8		6	8			7			8		7	11		9		AVERAGE
COIL ANGLE	21.4°	22.5°	57.3°	9°	24.8°	5.5°	21.4°	10.1°	16.9°	22.5°	21.4°	52.8°	12.4°	20.3°	21.4°	20.3°	360°
DIE ANGLE	43.9°		57.3°	39.3°			48.4°			43.9°		52.8°	32.7°		41.7°		360°

FIG. 6—Reconstruction, by group classification, of the original contents of the Hauptmann nail keg. All of the ladder nails were found to fall into these classifications.

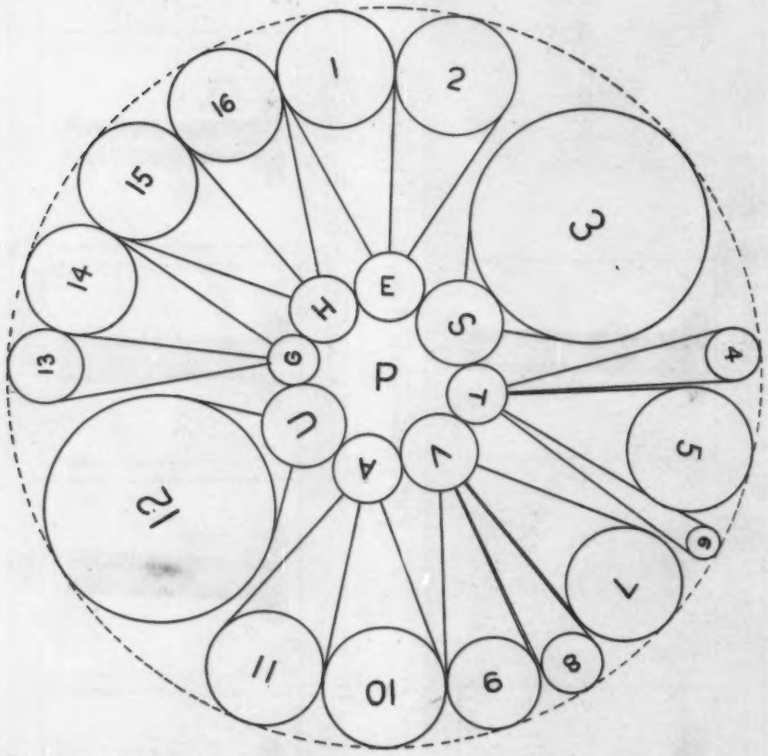


FIG. 7—Technological pattern of variations in coil proportions in the basic group with numerical strength of 320.

Fig. 6 is a tabulation of the mathematical factors involved in the procedure followed by the author ultimately to attain this end. By structural value is meant their total composite value in the basic group; while its reciprocal, group integer, is the index of the probable numerical strength of the group, required to develop this particular detail. Coil angle and die angle are notations used in the graphic representation of all these factors, in Fig. 7, whereby their proportional values in the group are shown in degrees along the total circumference of the circular graph as group unity.

It will be observed at once by their size, that there is a pronounced variation in their probable occurrences, illustrated as conceived when spun as a roulette. The factor in value involved is that of magnitude. To develop therefore the presence, as a detail of coil No. 6 constituting its remotest item, an intimate mixture of nails from this group will have to be at least equal to 64. Where the numerical strength is less than this minimum,

Die—Types	E		S	T			V			A		U	G		H	
Coil Numbers	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Diameter Numbers	.133¾	.134¼	.134¼	.135	.135¼	.135½	.133¾	.134	.134¾	.134¼	.134¾	.135	.133½	.134½	.134½	.135
Length Numbers	2.63	2.63	2.57	2.54	2.54	2.54	2.58	2.58	2.58	2.56	2.56	2.58	2.60	2.60	2.61	2.61
Weights in Gms.	5.00	5.06	4.87	4.90	4.91	4.96	4.88	4.91	4.93	4.83	4.85	4.90	4.86	4.87	4.95	4.98
Wire—Die	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Smooth	Double Pick Up	Heavy Pick Up	Smooth	Smooth	Pick Up	Smooth

FIG. 5—Identification of coils used in making nails found on Hauptmann's premises, as classified into die type groups.

for example 44, their mathematical probabilities will be shown, as in Fig. 8, to be that of the order of their prominence.

Having thus analyzed their probabilities, we may now construct a graph of this lot, without the details of magnitude, in order to make it comparable with fractional groups numerically too weak to justify anything like a dependable resolution to such a degree. Fig. 8 represents such a graph of this basic lot, by showing the related coils within their specific die type symbols, and may be taken as the pattern of the original mixture of the keg's contents as packed at Monessen.

It is to the unit and group characteristics of this lot that we shall now refer the ladder nails, to show their complete identity.

Ladder Nails Coincide With Basic Lot

Without tabulating here the details of diameter, length, weight and wire die conditions of these ladder nails, it will suffice to announce that they coincided, without exception, with the values found for the basic lot, as indicated in Fig. 5, thus establishing to their remotest degree of comparison, their complete unit identities therewith. The fidelity with which they showed their group identity to this same lot, is perhaps the most singular factor in the entire investigation.

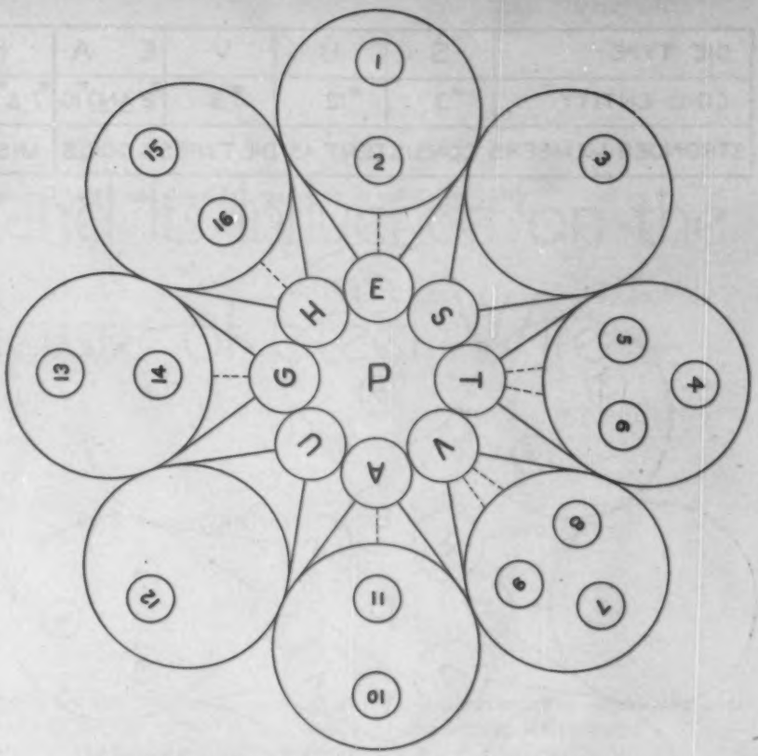


FIG. 9—Technological pattern of specific lot of nails on premises.

DIE TYPE	S	U	V	E OR A	H	T	G	
COIL ENTITY	*3	*12	*5	*2 OR *10	EITHER *1, *7, *11, *15	EITHER *14 OR 16	*9, *13, *8, *4, *6	
STRONGER MEMBERS, CONSISTENT AS DIE TYPES & COILS					WEAKER MEMBERS, COIL SELECTIVITY ONLY			

FIG. 8—Where the number of nails is less than 64, as for example in the case of the 44 taken from the ladder, the probable distribution above is expectable. (Compare this with Fig. 11.)

The missing coils shown by dotted lines as locations in Fig. 10 for the ladder group, when compared structurally with that of the basic lot in Fig. 9, actually follow the predicted probability for the numerical strength of 44 nails postulated in Fig. 8, as will be observed in comparing the order of prominence with that actually followed by the ladder nails indicated in Fig. 11. This is equivalent to saying that not only in every positive way, but even negatively by virtue of the *absence* of certain coils in the ladder nail group, this ladder group was identified as a component of the keg lot.

Figs. 12 and 13 are graphs of the two lesser components of this basic

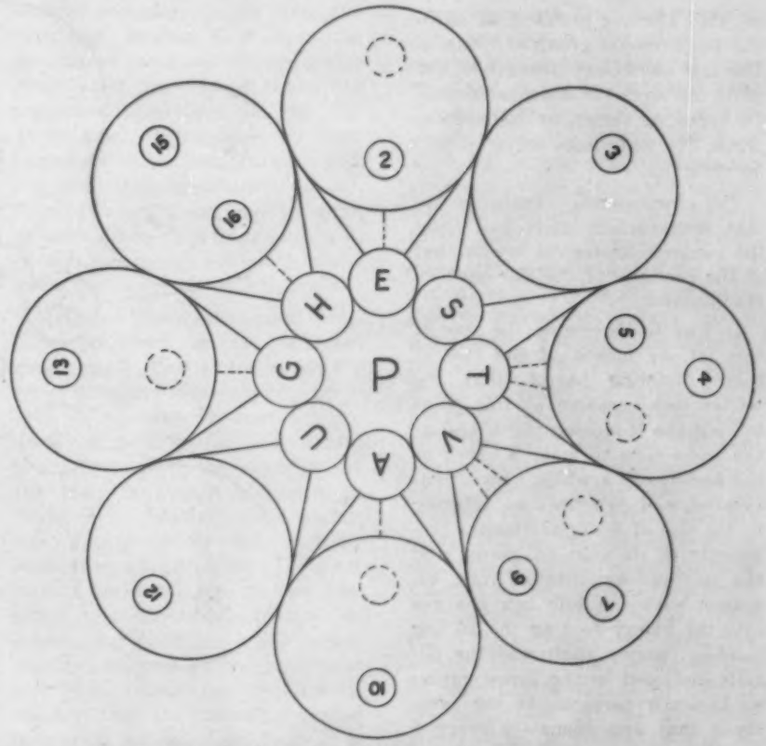


FIG. 10—Technological pattern of the 44 nails in the Lindbergh ladder.

DIE TYPE	S	U	V	E A	H	T	G	
COIL ENTITY	#3	#12	#5	#2 AND #10	#7 & #15	#16	#9, #13, #4	
STRONGER MEMBERS CONSISTENT AS DIE TYPES & COILS					MISSING: #1, AND #11, #14, #8, #6			

FIG. 11—Order of prominence of the ladder nails. Compare this with Fig. 8.)

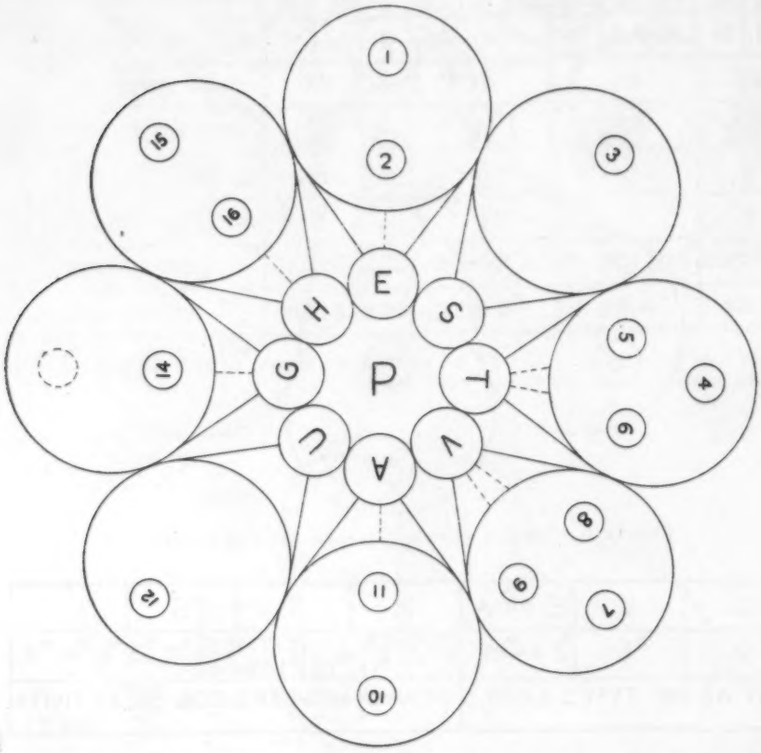


FIG. 12—Technological pattern of the nails found in Hauptmann's nail keg.

into the series by replacement, so too there is a new coil added to the setup every 8 min. Since tumbling serves, unintentionally of course, to integrate such a composition every hour, into a transient mechanical mixture of these varying and progressive phenomena, it follows that each successive discharge from the tumbler is strikingly individual after an hour's tumbling into a composite mixture of coil combinations within the closed series of die types. As a corollary, there could not therefore be more than these 16 kegs of such nails, ever produced before, or ever to be produced subsequently. Even the same state of repair of the dies is observed to be a common property of this lot.

The remarkable degree in exclusiveness, to which this technological lot is undeniably borne as a circumstance, is shown by its relationship to the total production of this type and size of nails. It is of the order of only half of one thousandth of one per cent!

The care with which the State

(CONTINUED ON PAGE 71)

lot, viz: The keg group of 42 nails, and the personal group of 10 nails. The low numerical strength of the latter involves the absence even of die types, as shown by dotted locations. No *new* units occur, it will be observed.

The inescapable conclusion is that these ladder nails hail from the same technological lot as that of the contents of the keg used by Hauptmann.

It was to determine the size of this lot, by means of the size of their tumbling barrel, that the writer took occasion at this point to visit the Monessen plant, and at the same time to make a check of the findings as a whole. Investigation of mill practices as relating to the use of 8 die assemblies frequently in such an 8d. setup, and the size and handling of coils, together with the tote box charges into the buggy feeding the 16 keg tumbler, amply confirmed the details disclosed in the investigation as basically correct. In the same sense that approximately every 8 hr. there is a new die introduced

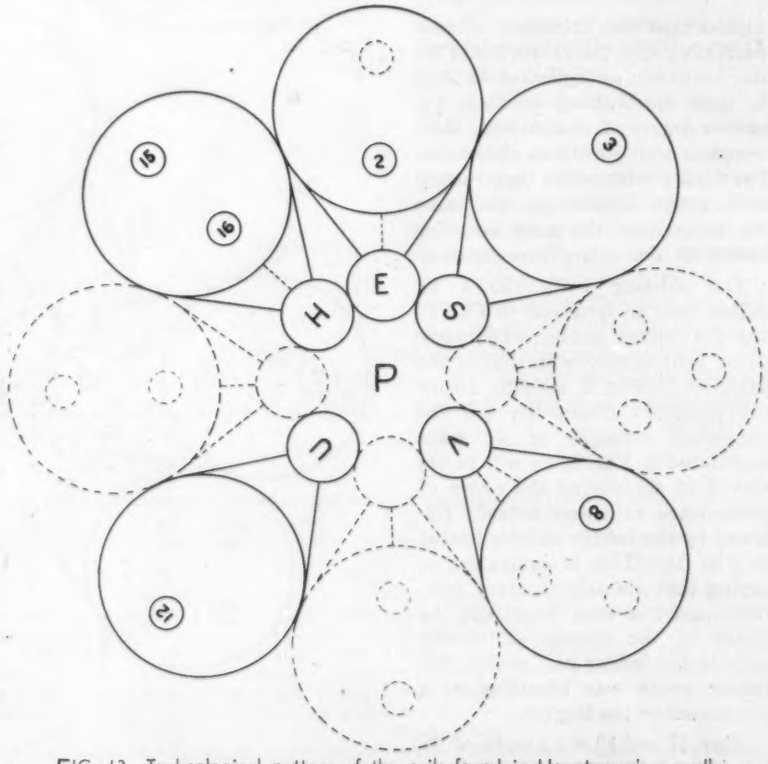


FIG. 13—Technological pattern of the nails found in Hauptmann's overalls.

Grain Size and Its Influence on the Manufacture of Steel Wire

o o o

By B. L. McCARTHY

o o o

A GENERAL survey of McQuaid-Ehn grain size control as applied to the making of steel wire was presented by the author in last week's issue. In addition to a general discussion on the subject of grain control, it was demonstrated how grain size may be used, both in the melting of basic open-hearth steel and in the selection of steel for wire drawing purposes. In this concluding article, the author reviews the influence of hot and cold work on the McQuaid-Ehn grain size, discusses grain coarsening temperatures, reaction rates and dissolved oxides. Also included are descriptions of the plastic deformation in wire drawing and the patenting operation.

o o o

TO show the effect of hot and cold working on the size of the grain developed by the McQuaid-Ehn grain size test the following samples were employed:

C-1

Coarse grain steel, 1¾ in. billet.

C-2

Coarse grain steel, No. 5 rod (hot rolled).

C-3

Coarse grain steel after 30 per cent reduction in drawing.

C-4

Same as C-3 after patenting.

C-5

C-4 after drawing 80 per cent.

E-1

Fine grain steel, 1¾ in. billet.

E-2

Fine grain No. 5 rod (hot rolled).

E-3

Fine grain steel after 30 per cent reduction in drawing.

E-4

Same as E-3 after patenting.

E-5

E-4 after drawing 80 per cent total reductions.

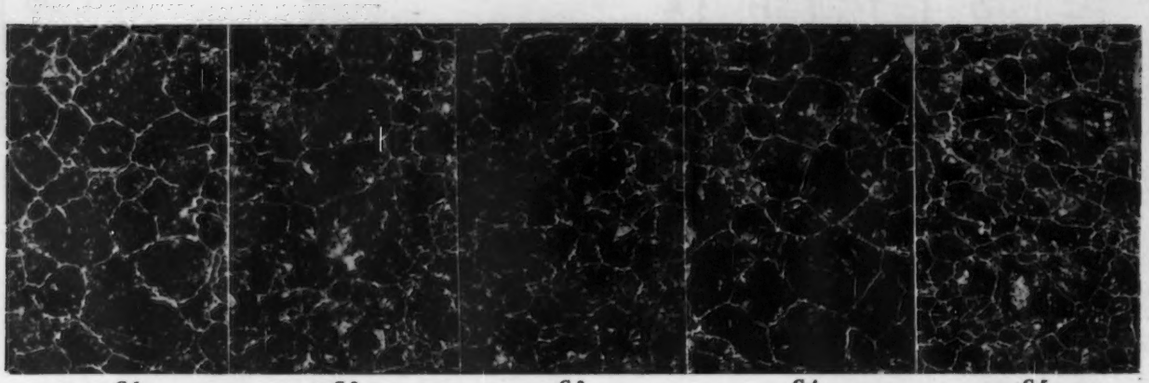
All the above samples were carburized according to the McQuaid-Ehn test. In Fig. 6 is shown the structures developed on the coarse grain steel and Fig. 7 shows the structures developed on the fine grain steel. While there is some variation in the structures resulting from these treatments the difference is not great enough to be of importance. The fine grain steels remain fine grain, while the coarse grain steels remain coarse grain.

McQuaid-Ehn grain size is sometimes referred to as "inherent grain size." This is incorrect, for while it indicates an inherent property or an inherent tendency toward the development of a certain grain size under the condition of the test, the grain size can be changed by heating to a higher temperature or by hot working above the upper critical. When steel cools from the molten condition the primary crystals or grains that form are much larger than is indicated by the grain size test. The reason for this lies in the fact that the austenitic grains formed on solidification, form at a temperature well above the grain coarsening temperature.

Coarse Grains in Large Sections

In the hot rolling of steel the austenitic grains which existed at time of heating are continually broken up due to pressure and the grain size of the hot-rolled material represents the size to which the grains developed after hot working had ceased. The size of the hot-rolled bar determines the amount of time permitted for the grains to grow after hot working, viz., the larger the section the coarser will be the grains. If, however, the rolling is continued until the material has cooled to a temperature in the neighborhood of 1700 deg. F. the grain size, as determined by the McQuaid-Ehn test, will exert an influence on the size of the austenitic grains developed.

As steel is cooled below the Ar 1 a new set of grains develop inside the old austenitic grains; this is particularly noticeable in low-carbon steels. The grain size noted in the hot-rolled low-carbon No. 5 rod is an example of this secondary or actual grain size. In high-carbon material the same condition exists and the grain size of the patented rod or wire indicates the actual and not the austenitic grain size. Fig. 8 shows the structure of a patented No. 5 rod of eutectoid composition—note the actual grain size. If, however, the structure contains any pro-eutectoid ferrite or cementite it will be present at the boundaries of the austenitic grains—this is shown in Fig. 9.



C 1 C-2 C-3 C-4 C-5

FIG. 6—Showing the effect of hot and cold work on the McQuaid-Ehn grain size of coarse grain steel. All photos at 100 diameters.

Fig. 10 is a photomicrograph of a McQuaid-Ehn grain size test taken at 200 diameters—note the grains that have formed inside the austenitic grains. The size of the austeniitic grains exerts an influence on the size of the actual grains, and it is therefore necessary to coarsen the austenitic grains to obtain a coarse patented grain size.

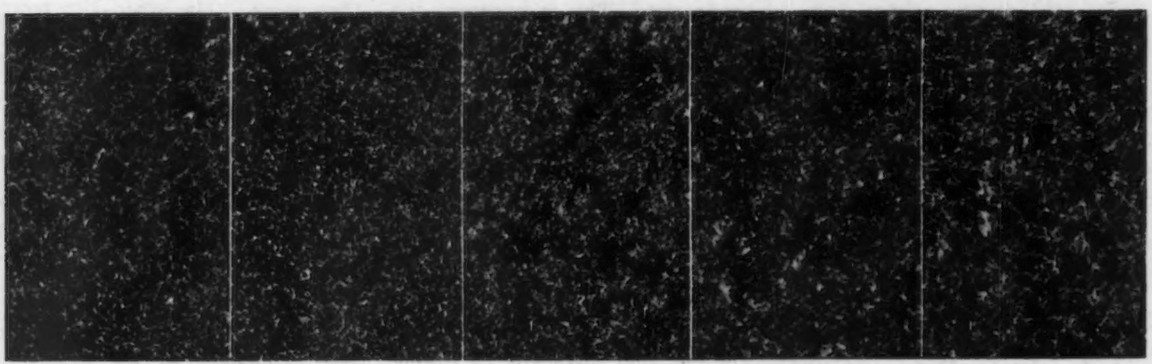
The temperature at which the austenitic grains coarsen has been the subject of much investigation. Coarse grain steels will coarsen shortly after the critical temperature is passed, but fine grain steels may remain fine at considerably higher temperatures. However, whether the steels are coarse or fine grain, as determined by the McQuaid-Ehn grain size test, if heated high enough they will all coarsen. The temperature at which the grains coarsen is termed the grain coarsening temperature. The fact that a steel is fine grain at 1700 deg. F., as determined by the McQuaid-Ehn test, indicates that its grain coarsening temperature is in excess of 1700 deg. F. Grossmann[6] has shown that the coarsening temperature can be lowered in a steel by special treatments such as heating and quenching a number of times. However, only the influence of hot and cold work on the coarsening temperature is important in the manufacture of wire. Grain coarsening proceeds over a range in temperature and, as a result, steels heated to within this range will show a marked non-uniformity of grain size. For this same reason some steels will show a non-uniformity when carburized at 1700 deg. F.

[6] Transactions, A.S.M., Vol. XXII, No. 10.

Aluminum Influences Grain Coarsening

Grain growth develops by the uniting of fine grains to reduce surface tension. Very often when fine grain steels are heated above their grain coarsening temperature extremely large grains develop. The amount of aluminum added to the steel to control grain size seems to influence the grain coarsening temperature, and this is probably due to the added obstruction to grain growth resulting from the formation of Al_2O_3 particles.

To demonstrate the effect of temperature and aluminum additions on grain growth, McQuaid-Ehn tests were made on one coarse and two fine grain steels at various temperatures. All samples were from the same heat, the fine grain steels having been treated with aluminum in the mold. Fig. 11 shows the grain size developed in the coarse grain steel by carburizing at various temperatures. Fig. 12 shows the results of carburizing a fine grain steel at various temperatures. This sample was treated with 6.5 oz. of aluminum per ton. Fig. 13 shows the effect of the same temperature on a fine grain steel to which 13 oz. of aluminum per ton was added. The fact that all of the above structures were obtained on the same heat of steel serves to demonstrate the influence of aluminum additions on the coarsening temperature. The coarse grain steel to which no aluminum has been added was coarse at 1600 deg. F. and continued to coarsen as the temperature was raised. The fine grain steel treated with 6.5 oz. of aluminum per ton began to coarsen at 1800 deg. F. and was almost completely coarse grained at 1900 deg. F. While there was some enlargement of the grains in the case of the sample to which 13 oz. of aluminum per ton was added, the coarsening temperature was in excess of 1900 deg. F.



E-1 E-2 E-3 E-4 E-5

FIG. 7—Showing the effect of hot and cold work on the McQuaid-Ehn grain size of fine grain steel. All views at 100 diameters.

To demonstrate the influence of cold work on the grain coarsening temperature the following samples from a fine grain steel were studied:

Sample A

Hot-rolled No. 5 rod.

Sample B

After a reduction of 35 per cent in drawing.

Sample C

After a reduction of 90 per cent in drawing.

All three samples were carburized for 8 hr. at 1700 deg. F., 1800 deg. F. and 1900 deg. F.

Photomicrographs of these samples show that at 1700 deg. F. there was a little difference, but as the temperature was raised to 1800 deg. F. and 1900 deg. F. sample B coarsened to a greater extent than did A or C. To establish definitely the influence of cold work on the coarsening temperature more work will be required. Indications, so far as determined, are that a small amount of drafting seems to cause the grains to coarsen at a lower temperature than that required for the hot-rolled rod, while heavier drafting seems to raise the coarsening temperature.

The structures developed were very erratic. In some instances the sample would be fine grain at the edge and coarse in the center and in others a reverse condition would exist. The samples used here, however, represent the general trend so far as determined.

[1] Transactions, A.I.M.E., Vol. 100, 1932.

Variations in coarsening temperatures are important in connection with patenting. The influence of cold working on the coarsening temperature indicates what might be expected in process patenting. A fact to keep in mind, however, is that while these influencing factors affect the coarsening tendencies of both coarse and fine grain steels, the coarse grain steels will continue to be coarse grain above 1700 deg. F. regardless of hot or cold working. It is therefore desirable to employ a coarse grain steel to avoid the nonuniformities that may exist as a result of variations in the coarsening temperatures associated with fine grain steels.

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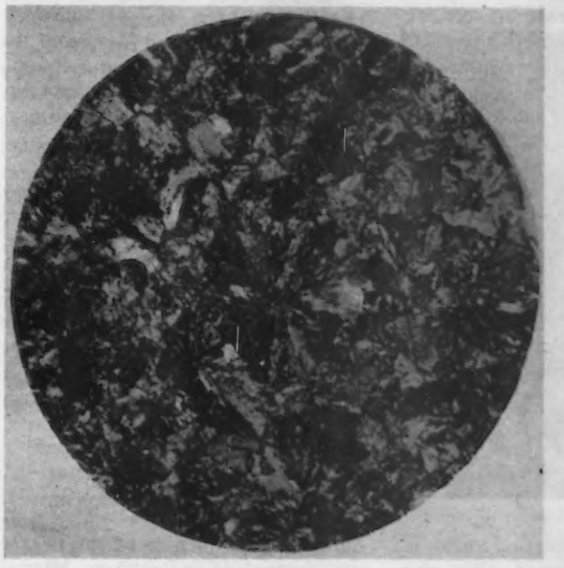
BELOW

FIG. 8 — Patented No. 5 rod of eutectoid composition lightly etched to show actual grains. Photo at 200 diameters.



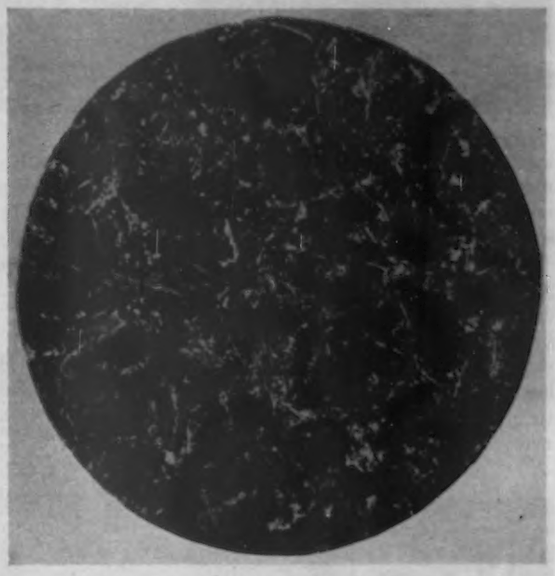
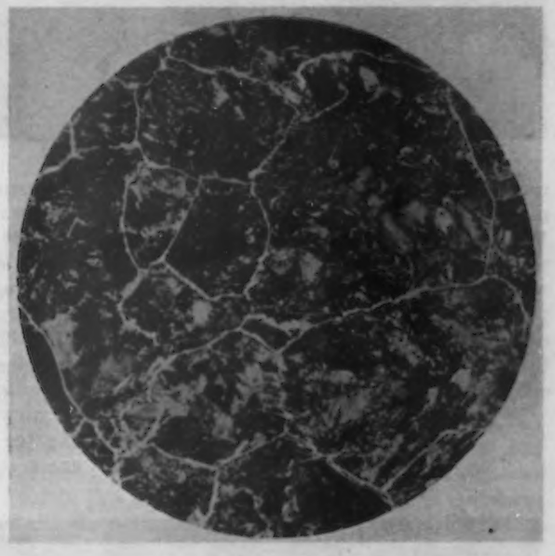


FIG. 9—Patented No. 5 rod, 0.70 carbon, 0.84 manganese, with a coarse grain. Ferrite markings of austenitic grains. Photo at 100 diameters.

AT RIGHT

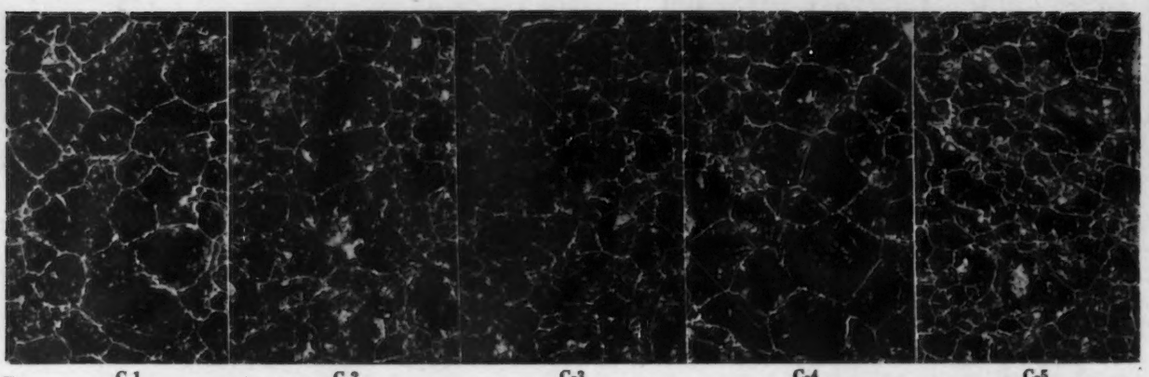
FIG. 10—McQuaid-Ehn grain size test taken at 200 diameters showing actual grains inside of austenitic grains.

o o o



Reaction Rates

Fine grain steels show a quicker reaction rate than coarse grain steels. By reaction rate[1] is meant the time required for the austenite→ferrite and carbide reaction which takes place at the Ar 1. A slow reaction rate will delay the transformation by lowering the position of the Ar 1, while a fast reaction rate will cause it to occur at a higher temperature. A slow reaction rate will increase the hardness and the hardness penetration and result in deep harden-



C 1 C-2 C-3 C-4 C-5

FIG. 6—Showing the effect of hot and cold work on the McQuaid-Ehn grain size of coarse grain steel. All photos at 100 diameters.

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[6] Transactions, A.S.M., Vol. XXII, No. 10.

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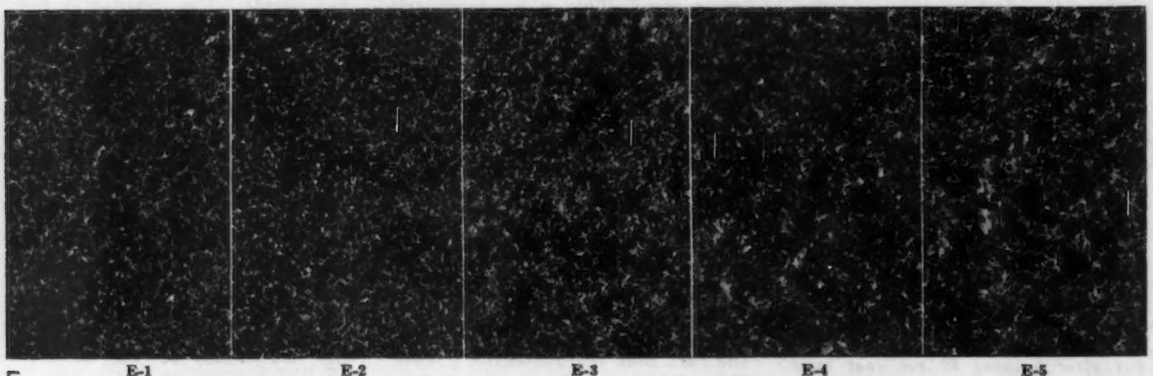
To demonstrate the effect of temperature and aluminum additions on grain growth, McQuaid-Ehn tests were made on one coarse and two fine grain steels at various temperatures. All samples were from the same heat, the fine grain steels having been treated with aluminum in the mold. Fig. 11 shows the grain size developed in the coarse grain steel by carburizing at various temperatures. Fig. 12 shows the results of carburizing a fine grain steel at various temperatures. This sample was treated with 6.5 oz. of aluminum per ton. Fig. 13 shows the effect of the same temperature on a fine grain steel to which 13 oz. of aluminum per ton was added. The fact that all of the above structures were obtained on the same heat of steel serves to demonstrate the influence of aluminum additions on the coarsening temperature. The coarse grain steel to which no aluminum has been added was coarse at 1600 deg. F. and continued to coarsen as the temperature was raised. The fine grain steel treated with 6.5 oz. of aluminum per ton began to coarsen at 1800 deg. F. and was almost completely coarse grained at 1900 deg. F. While there was some enlargement of the grains in the case of the sample to which 13 oz. of aluminum per ton was added, the coarsening temperature was in excess of 1900 deg. F.



E-1 E-2 E-3 E-4 E-5

FIG. 7—Showing the effect of hot and cold work on the McQuaid-Ehn grain size of fine grain steel. All views at 100 diameters.

To demonstrate the influence of cold work on the grain coarsening temperature the following samples from a fine grain steel were studied:

Sample A

Hot-rolled No. 5 rod.

Sample B

After a reduction of 35 per cent in drawing.

Sample C

After a reduction of 90 per cent in drawing.

All three samples were carburized for 8 hr. at 1700 deg. F., 1800 deg. F. and 1900 deg. F.

Photomicrographs of these samples show that at 1700 deg. F. there was a little difference, but as the temperature was raised to 1800 deg. F. and 1900 deg. F. sample B coarsened to a greater extent than did A or C. To establish definitely the influence of cold work on the coarsening temperature more work will be required. Indications, so far as determined, are that a small amount of drafting seems to cause the grains to coarsen at a lower temperature than that required for the hot-rolled rod, while heavier drafting seems to raise the coarsening temperature.

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Reaction Rates

Fine grain steels show a quicker reaction rate than coarse grain steels. By reaction rate[1] is meant the time required for the austenite→ferrite and carbide reaction which takes place at the Ar 1. A slow reaction rate will delay the transformation by lowering the position of the Ar 1, while a fast reaction rate will cause it to occur at a higher temperature. A slow reaction rate will increase the hardness and the hardness penetration and result in deep harden-

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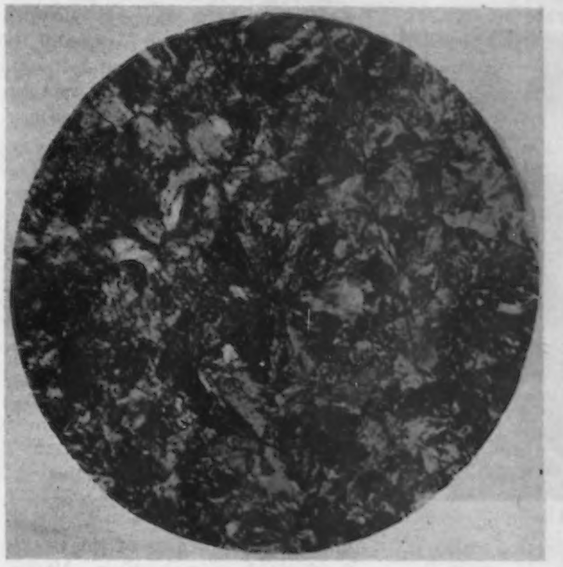
BELOW

FIG. 8 — Patented No. 5 rod of eutectoid composition lightly etched to show actual grains. Photo at 200 diameters.



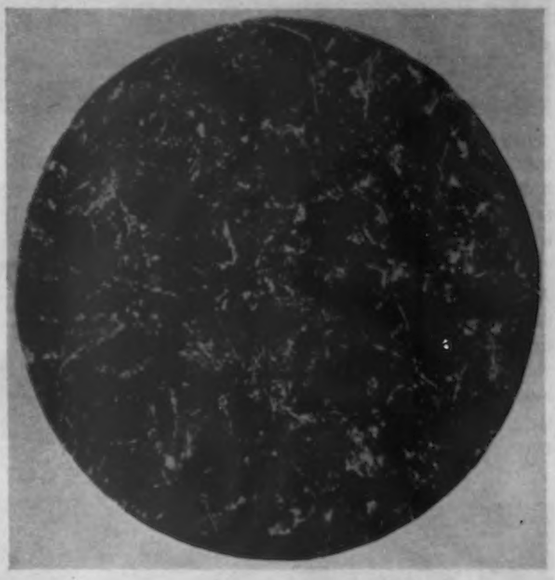
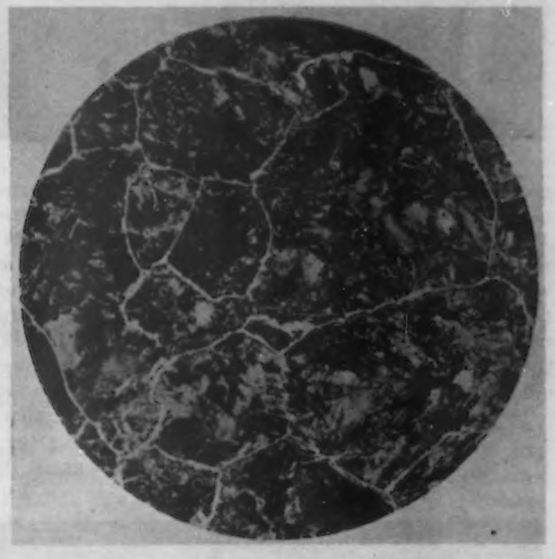


FIG. 9—Patented No. 5 rod, 0.70 carbon, 0.84 manganese, with a coarse grain. Ferrite markings of austenitic grains. Photo at 100 diameters.

AT RIGHT

FIG. 10—McQuaid-Ehn grain size test taken at 200 diameters showing actual grains inside of austenitic grains.



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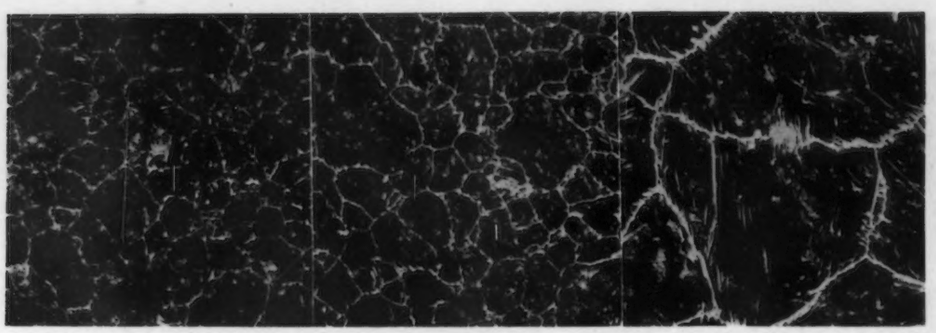

FIG. 11—Coarse grain steel carburized at 1600 deg. F. (on left), 1700 deg. (middle) and 1800 deg. (right) for 8 hr. The grain sizes are No. 4, No. 3 and No. 1, from left to right respectively.

ing. A fast reaction rate will, by increasing the rate at which the transformation takes place, result in shallow hardening.

The temperature to which the Ar 1 is lowered determines the type of micro-structure developed in a given steel. If the cooling is slow enough it may occur slightly below the phase-boundary temperature (line PSK—see Fig. 1). However, as the cooling rate is increased the transformation takes place at a lower temperature (line P'S'K'). Slow cooling results in the formation of coarse pearlite, while faster cooling will result in pearlite of varying degrees of fineness, depending on the position of the Ar 1.[8] When the Ar 1 is lowered to about 950 deg. F. the micro-structure will consist of fine pearlite. Below this temperature martensite will develop until, at a temperature of about 250 deg. F., the structure will be all martensite. A quench fast enough to produce martensite is termed a critical quench, while a rate of cooling slown enough to produce pearlite may be termed slow, medium or fast, depending on the position of the Ar 1.

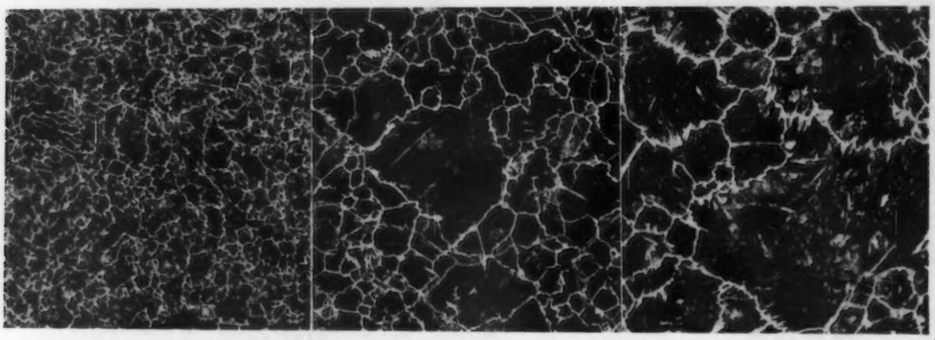

FIG. 12—Steel with 6.5 oz. of aluminum per ton carburized for 8 hr. at 1700 deg. (on left), 1800 deg. (middle) and 1900 deg. F. (right). Grain sizes are No. 6, No. 4, and No. 2, from left to right respectively.

In considering reaction rates it should be remembered that the analysis of the steel and the rate at which it is cooled will influence the position of the Ar 1. Also, analysis and rate of cooling being the same, a difference in the grain size of the steel will influence the temperature at which the Ar 1 transformation takes place, thus influencing the micro-structure. If a fine grain steel is heated above its grain coarsening temperature and a coarse austenitic grain is developed, its reaction rate on cooling will change from fast to slow, the influencing factor being the size of the austenitic grain.

The study of reaction rates deals mostly with a fast or critical quench, as when oil or water is employed as a quenching medium. However, a similar effect can be noted on less rapid cooling and may influence the fineness of the pearlite formed in patenting. Microscopic variations in the metal may cause microscopic variations in the reaction rate as does the presence of non-metallic inclusions and dissolved oxides.

Influence of Dissolved Oxides

Bain has shown that oxygen dissolved in steel influences the rate at which the carbide diffuses.[9]

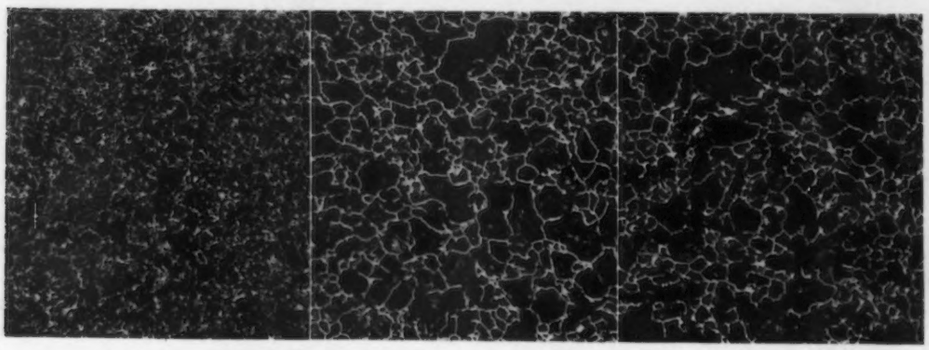

FIG. 13—Steel with 13 oz. of aluminum per ton, carburized for 8 hr. at 1700 deg. (on left), 1800 deg. (middle) and 1900 deg. (on right). Grain sizes are No. 7, No. 6, and No. 5, from left to right respectively.

[8] American Iron and Steel Institute, New York, May 24, 1934.
[9] Transactions, A.S.M., Volume XX, No. 5, November, 1932.

The structure which results is due to a fast rate of diffusion. The cementite diffuses to the boundaries of the austenitic grains and there results a poorly developed pearlite. Grossmann has suggested the presence of an increased solubility of cementite in ferrite which delays carbide precipitation until after the Ar 1 is passed. This is shown diagramatically in Fig. 1—the dotted line GPN represents the solubility of cementite in ferrite, the position of P changing with the dissolved oxide content and the cementite solubility resulting from it.

That dissolved oxides do influence the micro-structure is shown by the following examples: Fig. 14 shows the structure of a McQuaid-Ehn test made on a hot-rolled rod which originally contained a seam but in which, due to high temperature, the iron oxide has become dissolved in the metal. Note the massive cementite. This is similar to an abnormal structure, yet the steel in question was not abnormal. To demonstrate this point further a sample of 1¾-in. billet was prepared by cutting a groove ⅛ in. deep and 1/32 in. wide parallel with the axis. The piece of billet was then heated to 1800 deg. F. and forged to 1-in. round. It was then reheated to 2300 deg. F. for 10 min. and forged to ½-in. round. A McQuaid-Ehn test was made on the ½-in. round, and Fig. 14 shows the structure developed at 1000 diameters. The solution of iron oxide in the metal has resulted in the formation of massive cementite and ferrite similar to the other structure shown in Fig. 14.

This tendency to form massive cementite at the expense of the pearlite indicates the presence, in steel high in iron oxide, of an influence which would interfere with the development of fine pearlite in patenting and a tendency to form coarse particles of cementite which would delay solution.

The solution of the excess constituents which takes place above Ac 1 requires time. In heating for the general run of metallurgical operations a heating rate of 1 hr. for each 1 in. of section is generally employed. In the patenting operation heating is done in much less time than this. To accomplish solution at this increased rate of heating, temperatures considerably in excess of the Ac 3 must be employed. The presence of large ferrite-cementite particles in the material to be patented delays solution and may result in what is termed slack patenting. Coarse areas of pearlite, massive cementite and excessive ferrite all require time for solution, and it is therefore desirable for the particles to be as small as possible to promote the quick solution desired.

Herty, Lightner and McBride[10] have shown that in fine grain hypo-eutectoid steels there is a greater tendency toward the precipitation of free ferrite than is associated with coarse grain steel. This would indicate a slower rate of solution for this type of material. The tendency toward the formation of massive cementite in steels high in oxygen may also influence the solution rate. The complete solution of the constituents is essential to the production of good wire, both because of the necessity of complete solution for subsequent recrystallization and because grain growth cannot take place until solution is complete.

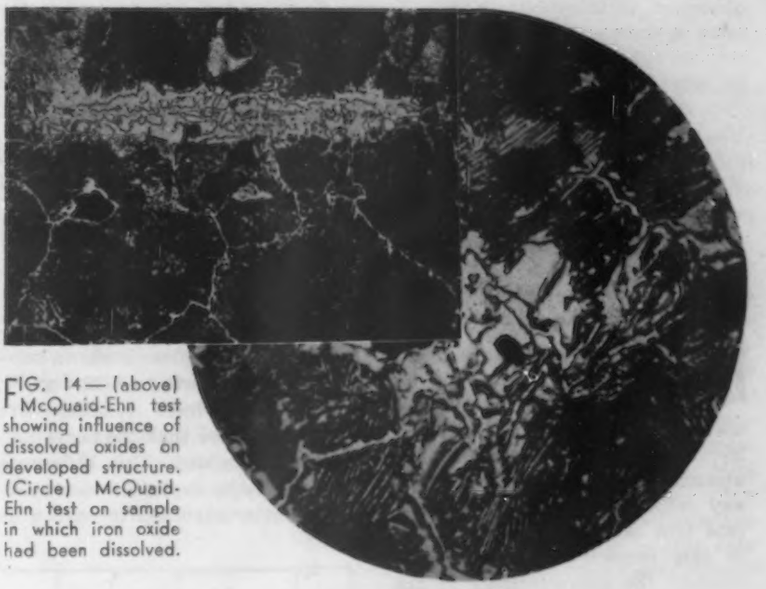

FIG. 14 — (above) McQuaid-Ehn test showing influence of dissolved oxides on developed structure. (Circle) McQuaid-Ehn test on sample in which iron oxide had been dissolved.

Deformation During Drawing

When wire is being drawn the size of the die determines the diameter. However, it does not follow that the strain set up is evenly distributed throughout the cross-section. We are all familar with the fact that steel hardens on being cold worked. The hardening which takes place is progressive in that the more plastic areas harden first and, as their hardness increases, other areas, which offer more resistance to plastic deformation, are affected. In this manner the resistance of the various areas is overcome. Sometimes, however, even with a heavy total reduction, there are areas that will not deform. Areas which do not deform, because their resistance is too great, place the burden of deformation on other areas and may result in overworking. The speed of drawing and the use of too heavy a reduction on each draft can, by not permitting sufficient time for flow, cause excessive hardening in certain areas and produce brittle wire.

The plastic deformation which takes place is the result of numerous slips along crystallographic planes without the loss of cohesion. If the deformation in certain areas is excessive the cohesion may be destroyed and brittleness result. Because of this it is necessary that the deformation be uniformly distributed throughout the cross-section to produce high quality wire.

The microstructure of the steel before drawing determines the distribution of the effects of cold work. Free ferrite, because of its plasticity, will deform readily, while areas of free cementite will resist deformation. The plasticity of pearlite, which consists of alternate plates of cementite and ferrite, depends on the thickness of the plates and their directional relationship to the axis of the wire.

(CONTINUED ON PAGE 80)

[10] Bulletin 64, Mining and Metallurgical Advisory Board.

▲ ▲ ▲ Aluminum in Modern

IN the first half of this Edward De Mille Campbell Memorial Lecture, presented in THE IRON AGE last week, Mr. McQuaid pointed out the importance centered in this country on grain size requirements, particularly for special purpose steels. This attitude was contrasted with the much less interest prevalent in Europe. Mr. McQuaid called attention to the present wide use, although carefully concealed, of aluminum to control hardenability, grain size, etc., and particularly the combination of aluminum addition with greatly improved knowledge and control of the basic open-hearth furnace itself. It was shown that the status of aluminum has changed completely in recent years, and is now being recognized by users of commercial steels as a most valuable element in the steels they use for particular purposes. In this concluding portion of his lecture, Mr. McQuaid discusses the importance of manganese in grain size control, points out the connection between the aluminum addition and hardenability, shows how silicon helps the aluminum, and checks the effects of different carburizing agents on normality of grain size.

o o o

STATEMENTS have been made to the effect that manganese has an important relation to normality, grain size, hardenability, etc. Thus, it is valuable to assemble, from the data available, any information which will indicate how important manganese is in this respect. As an example, consider the characteristics of the low manganese, low aluminum heats shown in Table IV.

In Table IV are heats that are all coarse grained by both the McQuaid-Ehn test and as actually normalized. These heats are very normal and show no grain growth because they are very coarse by the Shepherd standard, even at low temperatures. The hardness in the quenched condition is good for steel of this analysis.

To continue, examine some low manganese heats with a definite addition of aluminum, taking the heats shown in Table V.

Here we have an entirely different set of results. Normalized structures are fine grained and the carburizing test also shows a fine structure even after carburizing for 8 hr. at 1900 deg. F., and the hypereutectoid zone is definitely abnormal. The grain growth fracture test of Shepherd's shows relatively little growth to 1900 deg. F., and the hardness readings are markedly lower than the heats previously examined. This difference can hardly be explained in characteristics by variation in carbon or manganese. If the aluminum content is neglected, it is difficult to explain the difference between these two groups, so until something better shows up the difference will have to be credited to the aluminum addition.

Now, consider some high manganese heats with low aluminum content and see what the characteristics of this group are (see Table VI).

Again, in this case there is coarse-grained normalized structures, with the grain size after carburizing showing a coarse hypereutectoid zone with a normal cementite boundary. Apparently the addition of manganese to the first group examined does not change markedly the characteristics of the steel, although the hardening effect of the increased manganese is naturally noticeable. The Shepherd fracture grain growth test shows these heats to be on the coarse side up to 1700 deg. F. and definitely coarse above this.

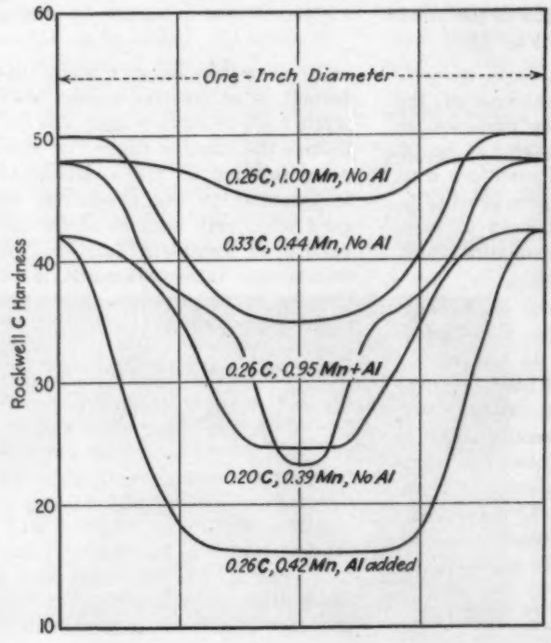

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FIG. 9—Showing the effects of manganese and aluminum additions on the hardenability of a 0.26 per cent C steel water quenched in 1 in. diameter section from 1700 deg. F. Note that 0.20 per cent C, 0.39 per cent Mn without aluminum hardens deeper than 0.26 per cent C, 0.42 per cent Mn + aluminum. Also that 0.33 per cent C, 0.44 per cent Mn without aluminum hardens deeper than 0.26 per cent C, 0.95 per cent Mn with added aluminum.

o o o

Commercial Steels

By H. W. McQUAID
Metallurgist, Republic Steel Corpn.

Now consider some high manganese heats to which aluminum has been added, such as shown in Table VII. These heats are interesting in that they show a fine grain structure both in the normalized and carburized condition and they are of the abnormal type in spite of the high manganese content. These results would indicate that manganese in itself is really of minor importance when we are interested in grain control, response to normalizing, etc. It would seem from a study of these heats examined, that small additions of aluminum have very marked effects on those characteristics of a heat of steel which are so important in controlling the heat-treated properties of the finished part. This, of course, is not offered as anything new, since it is exactly for these things that we have been adding aluminum to steel to govern its characteristics after heat treatment for more than 10 years. These results are given simply to show how much more important aluminum is in this respect than manganese.

It is interesting to compare the relative importance of aluminum additions and manganese additions on the hardenability of plain carbon steels. At this point an examination will be given of the depth hardness curves made by quenching 1-in. diameter round pieces in water at 1700 deg. F. and measuring the hardness at different depths by means of Rockwell hardness testing.

Fig. 9 shows the effects of manganese and aluminum additions on the hardenability of a 0.25 per cent carbon steel, water quenched in 1-in. diameter sections from 1700 deg. F. Note that the 0.20 per cent carbon, 0.39 per cent manganese without the aluminum, hardens deeper than the 0.26 per cent carbon, 0.42 per cent manganese with aluminum. Note also that the 0.33 per cent carbon, 0.44 per cent manganese steel without aluminum hardens deeper than the 0.26 per cent carbon, 0.95 per cent manganese steel to which aluminum has been added.

Now, consider Fig. 10, showing the effect of increasing manganese on the hardenability of 0.20 per cent carbon steel without the aluminum addition when quenched in 1-in. sections in water at 1700 deg. F. Note the comparative hardness of 0.39 per cent carbon, 0.80 per cent manganese steel without aluminum, indicating the relative value of carbon and manganese in improving hardness penetration.

Consider now another series of steels of approximately the same carbon but varying in manganese content and containing added aluminum (see Fig. 11). Note the result of adding aluminum, indicating the relative effects of manganese and aluminum on hardness penetration. Compare the steel without aluminum with the other three steels to which aluminum has been added, showing in this case that the steel with considerably less manganese and without added aluminum will harden comparatively better.

The comparative effect of aluminum as added on the hardenability of steels of approximately the same manganese and carbon content is shown in Fig. 12. While as discussed before, there is always some doubt as to the absolute accuracy of aluminum analysis, these heats selected according to increase in aluminum indicate that the hardenability decreases with increasing aluminum and perhaps according to some definite law. We could spend considerable time in discussing the curves shown because of their very valuable practical application. Steel of the analysis given is used in great quantities in the heat-treated condition, and very often for applications of different design in which the hardening

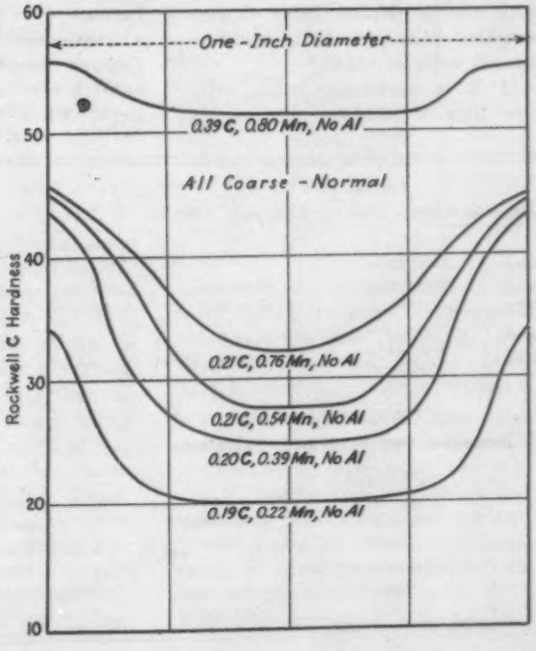

FIG. 10—Showing the effect of increasing manganese on 0.20 per cent carbon steel without aluminum addition, when quenched in 1 in. section in water from 1700 deg. F. Note the comparative hardness of a 0.39 per cent C, 0.80 per cent Mn steel, indicating the relative value of carbon and manganese in improving hardness penetration.

TABLE IV

Characteristics of Low-Manganese, Low Aluminum Heats

Heat Number	C	Mn	S	Al	Normalized Micro-Structure	McQuaid-Ehn Grain Size	Shepherd Fracture	Rockwell C. Center 1 in. Dia. as Quenched	Remarks
111	0.16	0.18	0.03	0.019	Coarse	Coarse and normal to 1900 deg. F.	Coarse at all temperatures	20	McQuaid-Ehn taken at 1600 to 1700 to 1800 to 1900 deg. F. Rockwell test quenched from 1700 deg. F. in water.
221	0.38	0.44	0.12	0.016	Coarse			37	
012	0.20	0.39	0.15	0.014	Coarse			25	

TABLE V

Low Manganese Heats with Added Aluminum

Heat Number	C	Mn	S	Al	Normalized Micro-Structure	McQuaid-Ehn Grain Size	Shepherd Fracture	Rockwell C. Center 1 in. as Quenched
321	0.32	0.26	0.03	0.120	Fine	Fine—Abnormal to 1900 deg. F.	Fine to 1900 deg. F.	17
312	0.26	0.42	0.17	0.156	Fine	Fine—Abnormal to 1900 deg. F.	Fine to 1800 deg. F.	17
411	0.26	0.41	0.09	0.173	Fine	Fine—Abnormal to 1900 deg. F.	Fine to 1900 deg. F.	16
212	0.26	0.49	0.17	0.120	Fine	Fine—Abnormal to 1900 deg. F.	Fine to 1800 deg. F.	17

characteristics are closely related to internal stresses developed in quenching sections of non-uniform thickness.

Several very interesting results from practice could be given where steels of this analysis have been found entirely unsuited for the parts for which they have been specified, due to being too deep hardening and thus tending to crack in quenching. In fact, suitability of this steel for most purposes depends entirely on the ability to produce this analysis to a controlled hardenability requirement.

Action of Aluminum Addition

Some results have just been shown indicating the connection between the aluminum addition, hardenability, grain size, grain growth, etc. At this point it is interesting to speculate on the reason for this connection. As stated before, it is generally assumed by the leading American metallurgists that the effect of aluminum is indirectly through submicroscopic particles of aluminum oxide which act as obstructing agents to grain growth and so produce the fine-grain steels with all the accompanying characteristics. Some metallurgists, however, do not entirely subscribe to this explanation of the effect of the aluminum additions.

It cannot be denied that submicroscopic dispersion of infusible aluminum particles in a heat of steel would tend to inhibit grain growth and would be a factor in the resultant effects on the characteristics of the steel. There are, however, some effects obtained with the aluminum addition which do not seem to satisfactorily line up with the aluminum oxide dispersion theory, and it might be well to discuss some of them.

If it is aluminum oxide, why does time of addition play so important a part? In electric furnace steel which has already been completely deoxidized by ferromanganese and ferrosilicon additions, not to mention finishing under a reducing slag of very low FeO content, why is it so important that the aluminum addition be made within a very limited time before pouring?

In large open-hearth heats, why does the effect of the aluminum addition decrease rapidly near the end of the pour? If aluminum oxide in collodial submicroscopic suspension is the primary cause of fine grain, grain growth control and hardenability control, why should the effect be so sensitive to time in the ladle? If this loss in effect is due to coalescence of the oxide particles, why, in the electric furnace, does fine-grain scrap show a marked tendency to produce fine-grained heats *without* aluminum or with very small aluminum additions, when dead melted? And

TABLE VI

High Manganese Heats with No Aluminum Addition

Heat Number	C	Mn	S	Al	Normalized Micro-Structure	McQuaid-Ehn Grain Size	Shepherd Fracture	Rockwell C. Center 1 in. Dia. as Quenched	Remarks
014	0.26	1.01	0.14	0.018	Coarse	Coarse and normal to 1900 deg. F.	Coarse to 1900 deg. F	45	Shepherd test somewhat finer below 1700 deg.
513	0.27	1.10	0.19	0.024	Coarse			46	

TABLE VII

High Manganese Heats with Added Aluminum

Heat Number	C	Mn	S	Al	Normalized Micro-Structure	McQuaid-Ehn Grain Size	Shepherd Fracture	Rockwell C. Center 1 in. as Quenched
413	0.26	0.95	0.25	0.156	Fine	Fine to 1900 deg. F.	Fine to 1900 deg. F.	23
323	0.36	0.74	0.15	0.117	Fine	Abnormal	Fine to 1900 deg. F.	30
223	0.49	1.49	0.18	0.130	Fine	Abnormal	Fine to 1900 deg. F.	57
324	0.49	1.44	0.18	0.124	Fine	Abnormal	Fine to 1900 deg. F.	58

why, in the electric furnace, does the simple act of "boiling down" a heat of fine-grain scrap eliminate this fine-grained tendency?

If steels of relatively low oxide content exhibit the fine-grain characteristics with relatively low aluminum addition, why is more aluminum required for the more highly oxidized steel? Thus, Ohman states that aluminum in much smaller amounts than is customary in America can definitely improve the hardening range of Swedish steels. He illustrates this by showing that less than 3 oz. of aluminum per gross ton added to a 1.10 per cent carbon electric furnace steel ingot definitely improves the grain growth characteristics and states that the depth of hardening is somewhat reduced by an addition of aluminum.

In American basic electric furnace practice where a so-called reducing slag is used under which to complete the oxidation, it has been found that the amount of aluminum required to obtain a certain definite grain size is less than in the basic open-hearth heats which are more highly oxidized. It might be argued that the same quantity and distribution of aluminum oxide should give the same grain size, and that no extra aluminum would necessarily be required for the more highly oxidized heats unless a definite percentage of metallic aluminum in solution was required. If a critical amount or particle size of aluminum oxide is necessary as would be expected, how could increasing aluminum above the minimum produce fine grain in overoxidizd heats? It seems rather doubtful if the delicate control implied by the necessity of obtaining critical particle size and distribution could be obtained at all in the highly oxidized heats, or that increasing aluminum to a uniformly higher amount would produce the same critical dispersion of oxide particles in the more highly oxidized basic open-hearth heats that would be obtained in the electric furnace heat with a lower aluminum addition.

It might be argued also that since the addition of approximately one pound of aluminum per ton will be sufficient to completely deoxidize or kill an ordinary open-hearth heat, no possible change could be made in the amount or size of the aluminum oxide with aluminum additions above one pound per ton. It is a well-known fact, however, that in the ordinary well-made basic open-hearth plain carbon heat which has been deoxidized with ferromanganese and ferrosilicon that considerably more than one pound of aluminum per ton in the ladle is required to obtain the very fine-grain characteristics, and that much higher additions than one pound per ton are required where the grain-growth control specifications are exacting.

It seems more logical to assume that more highly oxidized heats require the excess aluminum to satisfy the oxide present and that the excess above that required to satisfy deoxidation requirements is necessary for grain growth control.

While it is difficult to prove, actual practice indicates very little effect in establishing fine grain characteristics is obtained by an aluminum addition until a certain definite minimum is added and then the fine grain effect is obtained very rapidly. This phenomena can be checked by any melter who has tried to govern his practice to obtain intermediate grain size control. He will insist that fine or coarse grain specifications are not so difficult to meet but that intermediate sizes are, in his opinion, "commercially impossible." This would indicate a very narrow range of particle sizes and dispersion, and if it is as difficult as the melter would insist, it would seem

AT LEFT

FIG. 11—Effect of increasing manganese on a medium carbon steel containing relatively heavy additions of aluminum, when quenched in 1 in. diameter section in water, from 1700 deg. F.

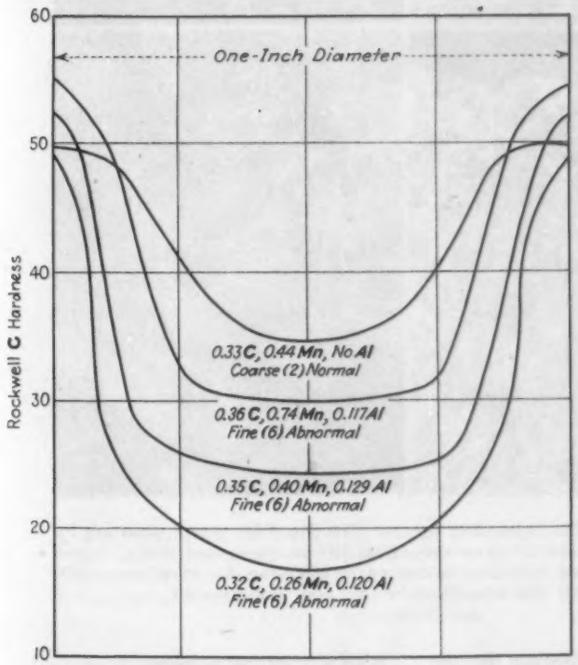

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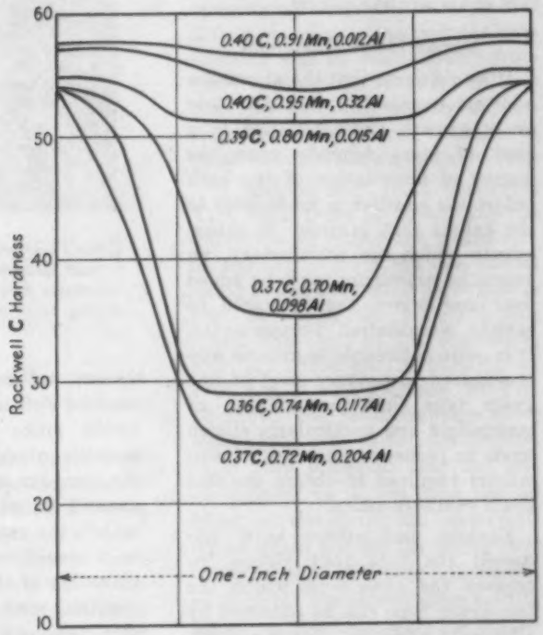
FIG. 12—Showing the effect of increasing aluminum addition on hardenability of medium carbon, manganese steel quenched in 1 in. section from 1700 deg. F. in water.



that it would be very difficult to obtain hundred ton heats of steel with the remarkable uniformity of grain size which can be now obtained in either the definitely coarse grain or fine grain types. One of the unexpected characteristics of grain size control is this uniformity, and to those of us who have checked thoroughly the grain size from the first molten steel in the furnace to the final products, there is nothing more remarkable than the fact that under normal conditions of processing the variation in the McQuaid-Ehn grain size is almost commercially negligible.

That this should be the case where we are depending upon the submicroscopic dispersion of infusible particles of a very definite critical size, is hard to believe. There is no doubt, of course, but what the presence of such particles would have an effect upon the grain size, and hence play a part in the establishing of the grain size and grain growth effects.

Silicon Helps Aluminum

It would seem that the aluminum addition required to obtain certain grain growth characteristics in a heat of steel depends upon the degree of deoxidation of the bath before the addition is made, only to the extent that in order to obtain effects which are satisfactory, an excess of aluminum must be added over and above that required to satisfy deoxidation requirements. It is quite noticeable to anyone who is required to produce steel of fine grain type that the addition of manganese and particularly silicon tends to reduce the amount of aluminum required to obtain the fine grain characteristics.

Epstein and others have discussed the fact that silicon increases the ease with which the fine grain type can be obtained by aluminum addition, showing clearly the effect of the presence of silicon and manganese in reducing the amount of aluminum required. Enlund, in discussing a report by Ohman, states that the aluminum addition alone is without effect—that only when the steel from the outset contains a minimum percentage of silicon or if the silicon is simultaneously added, that the steel exhibits resistance to grain growth. These observations in regard to silicon and its effect in combination with aluminum would indicate that a reduction in the amount of oxide present in the form of FeO in solution in the steel would make more effective the metallic aluminum in solution in the iron, due to the reduction in the amount of aluminum required to satisfy the oxide present. Certainly it would not seem that the explanation of the reduced aluminum required with the well deoxidized steel as compared to the more highly oxidized steel can be explained by the greater ease in obtaining sub-microscopic particles of the critical size dispersed uniformly throughout a large heat of open hearth steel.

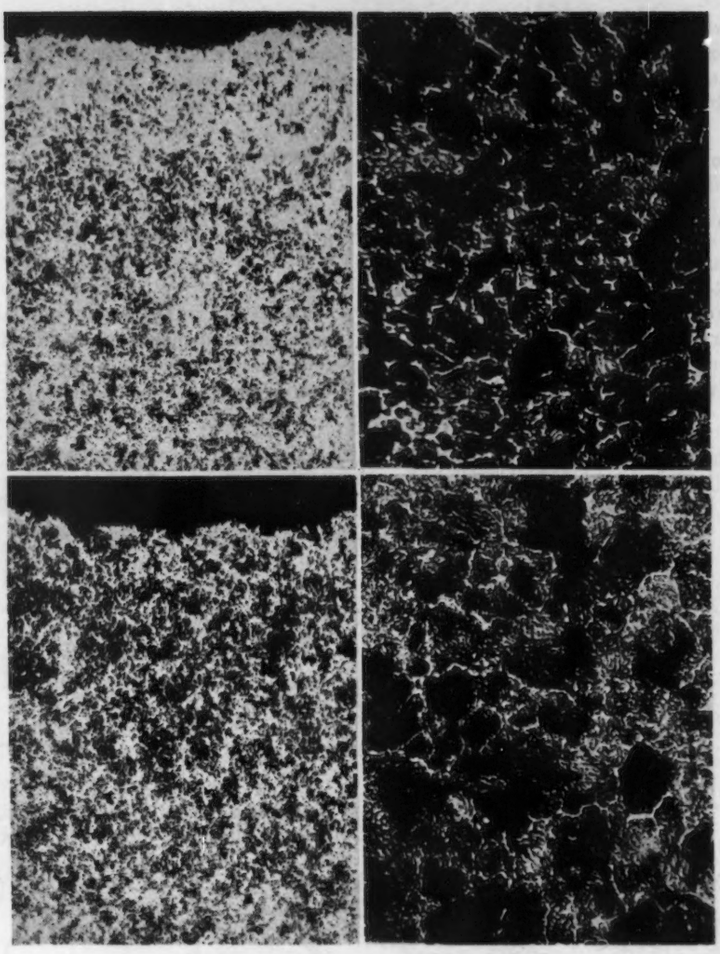


FIG. 13—McQuaid-Ehn carburizing test (at 1710 deg. F.). Upper views are for heat 223, at 100 and 500 diameters, from left to right respectively. Lower views are for the same heat, only carburized at 1800 deg. F. Views are at 100 and 200 diameters, from left to right respectively.

At this point the theory that it is metallic aluminum and its effect on the austenite transformation and carbide solubility that is the primary factor in grain growth variation and normality fits better into the practice. It should of course be assumed that any addition or element which affects carbide (or carbon) solubility should have the same effect. Dealing with aluminum as we are, it is reasonable to explain the importance of the time factor by the activity of the oxidation reaction with aluminum at steel making temperatures and argue that the loss of the aluminum effect in pouring open-hearth heats is due to the formation of aluminum oxide by oxidation under an open hearth slag of fairly high oxide content. It can be argued that in dead melted electric furnace heats, the oxidation may be insufficient to reduce the metallic aluminum content below that necessary to affect the grain size, so that the fine grained dead melted charge may still remain fine grained when melted. Also, on the other hand, the introduction of iron oxide in the form of ore to reduce the carbon would tend to reduce to a trace the metallic aluminum in the molten bath. It,

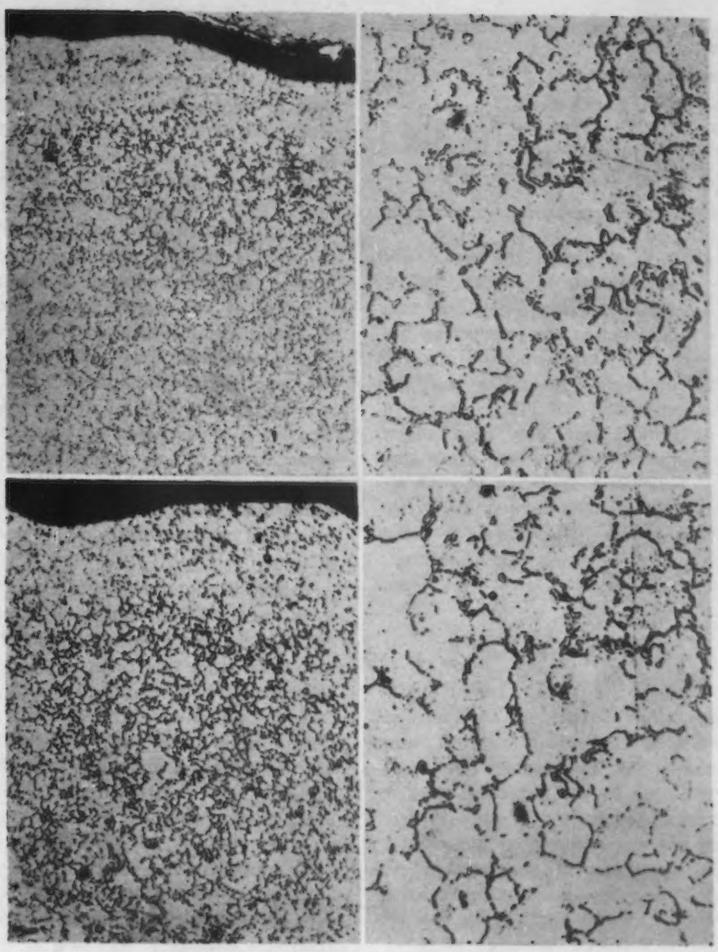


FIG. 14—McQuaid-Ehn carburizing tests at 1710 deg. and 1800 deg. F. Electrolytic etch in sodium picrate. Upper photos are at 1700 deg. and shown here at 100 and 500 diameters from left to right respectively. Lower photos were carburized at 1800 deg. and shown here at 100 and 500 diameters, from left to right respectively.

of course, could be argued that the oxide particles would, in the case of the dead melted heat, be relatively unaffected whereas in the "boiled down" heat the physical action produced by the gas evolution or boil would result in coalescence of the oxide particles. Yet the fact that holding a fine grain basic open-hearth heat for a relatively short time (as compared to finishing an electric heat) in the ladle will cause a loss of the aluminum effect indicates that the cause is probably not physical.

That extremely small additions of oxide, etc., are active in affecting the carbide structure, is evident from the fact that in compound carburizing, according to Grossmann, oxygen is absorbed which is directly the cause of abnormality in heats containing low manganese contents. He found that as the manganese increased, the oxygen absorbed decreased so that at manganese contents above one per cent little if any oxygen would be absorbed.

He also took samples which were abnormal when carburized in compound and by carburizing them in oxygen free hydrocarbon gas demonstrated that they became normal. While no analysis was made of his samples for aluminum, it is quite certain that the aluminum content was very small, especially in the low manganese heats.

The gas used in the experimental work in developing the oxygen absorption theory was specially prepared and supposedly entirely free from oxygen. It is known to those who have had experience with both the commercial gas carburizing and the commercial compound carburizing that the abnormal type of steels were found when carburizing by either method on a commercial scale.

In an effort to check the effect of the carburizing agent on the normality and grain size, twenty-one of the experimental heats were carburized in carburizing compound and samples from the same portion of the same bar from each heat were also carburized in a commercial gas carburizing furnace. The gas used in carburizing consisted principally of methane with ethane and other hydrocarbons up to 99 per cent. The balance was nitrogen with oxygen up to a maximum of 0.3 per cent. The sulphur was not more than a trace. The compound carburized pieces were carburized at 1700 deg. F. for 8 hr., cooled in the furnace to 800 deg. F. in 2½ hr. and then cooled in air. A second run was also made at 1800 deg. F. and cooled in a similar manner to determine the McQuaid-Ehn grain size and structure at these two temperatures.

The gas carburized runs[1] were made at 1700 deg. F. for 6 hr. and at 1800 deg. F. for 5 hr. at temperature. The work from the gas carburizing furnace was cooled slowly in mica. The gas for carburizing was on continuously from start to finish in an effort to prevent the presence of any oxygen from the atmosphere. Results of these runs are shown in Table VIII.

It will be seen from the Table VIII that there is practically no difference in either the grain size or normality from the gas carburizing or the compound carburizing. Fig. 13 shows the standard McQuaid-Ehn tests at 100 diameters, heat 223 after gas carburizing at 1700 deg. F. and 1800 deg. F. Fig. 14 shows the same samples after electrolytic etch in sodium picrate. It is very apparent that the gas carburizing as it was done had no effect on the structural abnormality or grain size of the pieces carburized. It is of course not intended to imply that these same results would be obtained with the carburizing gases absolutely free from oxygen, but it is quite evident the absorbed oxygen effect must be due to the results of relatively minute quantities of oxygen. As a further check, samples from heat 324 and 423 were very carefully analyzed for oxygen before and after carburizing with the result shown in Table IX.

The oxygen values in Table IX check with Grossmann's finding in

[1] Gas carburizing runs made by L. D. Gable, metallurgist for Timken Roller Bearing Co.

TABLE IX

Change in Oxygen Content in Pack-Carburizing

Heat Number	C	Mn	Si	Al	Oxygen in Per Cent Before	After	Decrease	
324	0.49	1.44	0.18	0.124	0.0865	0.0448	0.0417	Both Heats
423	0.49	1.41	0.25	0.046	0.0893	0.0635	0.0258	Abnormal

that the heats in question were high in manganese and showed, not an absorption, but an evolution of oxygen. They do indicate that since oxygen was lost rather than absorbed during carburizing, that the abnormal structure in these heats was not in any way connected with oxides formed during carburizing. Undoubtedly the abnormal structure found in these heats was due to aluminum. It is quite possible that the normal structure found in the heats carburized in hydrocarbon gas free from oxygen was due to the relatively slow carburizing action of such a gas where special means are not taken to remove the soot formed in carburizing. If the carburizing action is slow enough, the solution in the austenite of the carbon or carbide formed may be fast enough to reduce the excess carbides to the point where they neither interfere with the grain growth or promote coalescence of the lamellar carbide at the grain boundary.

If we are to assume that it is the aluminum in the steel in addition to that required to satisfy the deoxidation requirements which is effective in obtaining the resistance to grain growth characteristics of so-called fine grain steel, how can we explain then the connection between this aluminum and the results obtained? Assuming that the characteristics of the steels to which aluminum has been added are evident by decreased grain size and resistance to grain growth as well as decreased hardenability, we might assume that there is some connection between the aluminum, the hardenability and the grain size.

Hardening Procedure

The most important factor in the hardening of steel as we know it today, is the carbon content, and we find as the carbon increases from zero to the eutectoid that it becomes easier to obtain higher and higher hardness by quenching. The fundamental requirement of hardening steel is to so control the speed of quenching that the rate of cooling within a limited range of temperature will be sufficiently high so as to completely suppress the pearlite transformation. These requirements have been most clearly and thoroughly covered by Bain and are cited to center out interest for the moment on the fundamental requirement in hardening steel. It is apparently necessary in order to obtain satisfactory results from a rapid cooling, that we start from a solution of carbon (or carbide) in austenite and cool this at the critical rate mentioned above. Time is required to obtain solution of the carbon or carbide in the austenite and the time required varies not only with the carbide composition but also with the size and distribution of the carbide. Thus it is well known that spherodized carbides are difficult to get into solution, and a higher temperature and more time is required when the carbon exists in this condition.

It it well known that the solubility of carbon or carbide in austenite varies with the composition of the austenite and the form in which the carbon is present. Vanadium carbides are particularly difficult to get into solution and vanadium steels quenched directly from the carburizing temperature will almost invariably show the presence on the surface of an extremely high concentration of almost pure carbides. This indicates that at the carburizing temperature and under the conditions existing at the surface of the steel, these vanadium carbides were forming faster than the austenite absorbs the carbon

(CONTINUED ON PAGE 84)

TABLE VIII

Showing the Effect of the Carburizing Agent on the Normality and Grain Size

Heat Number	Pot Carburized 1710 deg. F. Case Grain Size	Pot Carburized 1710 deg. F. Boundary Rating	Pot Carburized 1800 deg. F. Case Grain Size	Pot Carburized 1800 deg. F. Boundary Rating	Gas Carburized 1700 deg. F. Case Grain Size	Gas Carburized 1700 deg. F. Boundary Rating	Gas Carburized 1800 deg. F. Case Grain Size	Gas Carburized 1800 deg. F. Boundary Rating
412	6 to 7	Abnormal	1 to 2	Slightly Abnormal	6 to 7	Abnormal	6 to 7	Abnormal
321	6	Abnormal	6 to 5	Abnormal	6	Abnormal	6	Abnormal
212	7	Abnormal	6 to 7	Abnormal	6 to 7	Abnormal	6 to 7	Abnormal
312	7 to 6	Abnormal	7 to 6	Abnormal	6	Abnormal	6	Abnormal
411	7	Abnormal	7 to 6	Abnormal	7 to 6	Abnormal	7 to 6	Abnormal
313	7	Abnormal	7	Abnormal	7 to 6	Abnormal	7 to 6	Abnormal
223	7	Abnormal	8 to 7	Abnormal	8 to 9	Abnormal	8 to 9	Abnormal
324	7	Abnormal	7 to 6	Abnormal	7 few 5	Abnormal	7 to 8	Abnormal
423	6 to 4	Abnormal	5 to 2	Slightly Abnormal	6 to 4 few 3	Abnormal	6 to 4 few 2	Abnormal
322	7	Abnormal	7 to 6	Abnormal	6 to 7	Abnormal	7	Abnormal
421	7	Abnormal	7 to 6	Abnormal	6 to 7	Abnormal	6 to 7	Abnormal
012	2 to 1	Normal	2 to 1	Normal	3 to 2	Normal	3 to 2	Normal
311	7	Abnormal	7 to 6	Abnormal	6	Abnormal	6	Abnormal
118	6	Abnormal	5	Normal	5 to 6	Abnormal	5 few 2	Abnormal
117	5	Normal	6	Slightly Abnormal	6	Abnormal	6 few 5	Abnormal
114	7 to 6	Abnormal	6	Abnormal	7	Abnormal	6 few 2	Abnormal
115	7	Abnormal	7 to 6	Abnormal	7 to 8	Abnormal	7 to 8	Abnormal
413	6 to 2	Abnormal	6	Slightly Abnormal	6 to 3	Abnormal	6 to 5 few 2	Abnormal
222	7 to 6	Abnormal	7 to 6	Abnormal	7 to 6	Abnormal	7 to 6	Abnormal
323	7 to 6	Abnormal	7 to 6	Abnormal	7	Abnormal	7 to 6	Abnormal
422	6	Abnormal	6 to 7	Abnormal	6 to 5	Abnormal	6 to 7	Abnormal

Manufacture and Finish Of Golf Shafts

By R. P. BROWN

The Timken Steel & Tube Company, Canton, Ohio

EVERY year an increasing amount of steel is used in the manufacture of shafts for golf clubs. This has developed into a highly specialized industry, and the American Fork & Hoe Co. has been conducting experiments for the past 10 years in a constant effort to develop steel shafts which will fully meet the needs of all golfers. This has, of course, covered a wide range, for the American golfer is not only a follower of fashions, but also is convinced that he needs a special shaft for his individual use. Those with strong wrists and supple wrists want their shafts very stiff. Those who are older or who have stiffened up a bit, but who have developed keen sense of timing want their shafts extremely whippy.

The American Fork & Hoe Co. has perfected its manufacturing processes to such a point that practically every golfer can now get a "True Temper" shaft with the desired characteristics. (Fig. 1.) This means that production facilities must be highly flexible as well as efficient, for not only will shaft weight vary, but also step location and type of finish.

Extremely rigid specifications covering both the chemical and physical properties of the steel used have been developed by the company, and all steel must have a fine grain, 6-8 being required. These qualifications have been met by one of the Timken controlled grain size alloy steels, which are consistently uniform in quality. Uniformity is particularly essential in connection with the drawing and tempering operations.

When the cold-drawn tube stock reaches the American Fork & Hoe plant it is inspected, cut to length, fully annealed in a specially designed electrically heated salt bath and quenched in water. The quenching bath consists of three stages, the last being clear fresh water. Following this operation the tubes are cut into six lengths and copper flashed in a copper sulphate solution prior to drawing.

Even though the electrically heated salt bath is more expensive to maintain than other types of furnaces, the company has found that they get the best results with it. It is rapid, taking only about half as long to anneal the tubes as did an open-type furnace formerly used. Heat distribution is uniform, temperature control to ±5 deg. F.

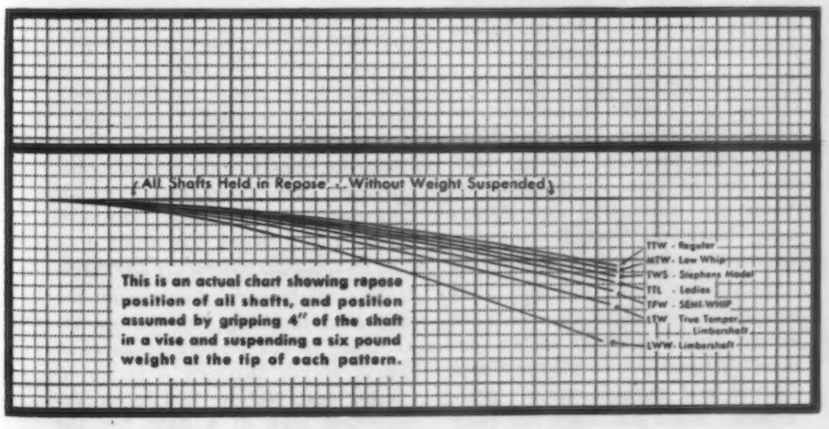

All Shafts Held in Repose Without Weight Suspended
This is an actual chart showing repose position of all shafts, and position assumed by gripping 4" of the shaft in a vise and suspending a six pound weight at the tip of each pattern.
TTW - Regular
TWS - Stephens Model
TTL - Ladies
TFW - Semi-Whip
LTW - True Temper Limbershaft
LWW - Limbershaft

FIG. 1

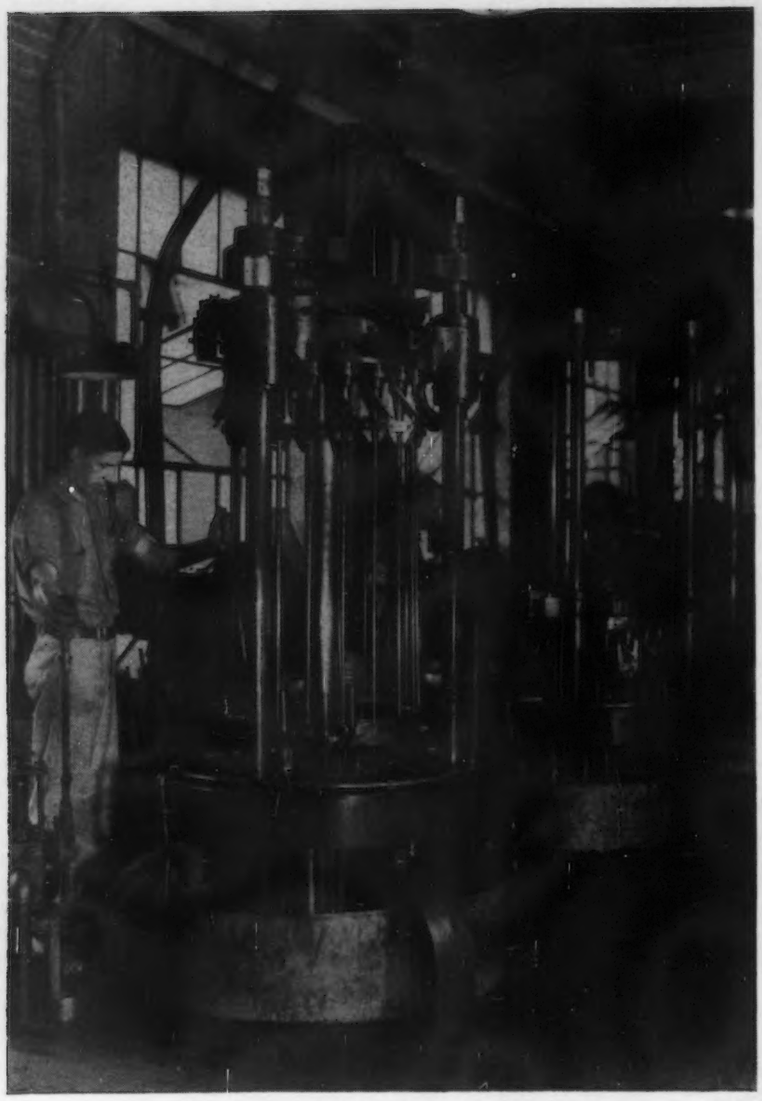


FIG. 2—Battery of extruding presses in which true temper golf shafts are "stepped."

is readily secured, and no decarburizing can occur. The bath is cleaned twice a week to remove the iron oxide sludge. Likewise, the solution from the first section of the quenching bath is passed through an evaporator, thus salvaging the salt and eliminating the problem of disposing of waste salt water.

A battery of quick action cold draw benches reduces the tubes to the desired wall thickness, great stress being laid on the importance of concentricity. Cemented tungsten carbide dies and mandrels are used in all stages. Following each pass the tubes are cut to length if necessary, annealed in a salt bath and flash copper plated. The die lubricant used is a special product developed at the plant to meet the particular needs. Normal production now calls for 5000 finished tubes cut to length every day. It is interesting to note that tube stock is drawn to approximately 90 times its original length before it leaves the draw benches.

Furnishing shafts to many different golf club manufacturers necessarily means the production of a wide range of tubing sizes, and this in turn necessitates extreme care in sorting and inspection. Maximum weight tolerance per shaft as the stock leaves the cold-drawing department is 1/32 oz. Unfinished shafts vary in weight from 3⅝ oz. to 5¾ oz., depending upon the length, stiffness desired and manufacturers' preferences. Stock diameters run from 0.432 in. to 0.625 in. Outside diameter can be closely checked by micrometer readings, but I.D. on such a long piece is extremely difficult to measure. However, close inspection of the drawing mandrels, plus individual visual inspection of each shaft, coupled with accurate weighing on a precision scale of each shaft, effectively controls production and keeps it to a high degree of precision.

Following drawing, the plain shafts are sent to another department, where the straight tubes are again formed to give them the desired taper. This is done in a specially designed extruding machine which automatically reduces the shaft from tip to butt in a series of steps. This controls the wall thickness of the tubing and likewise the character of flexibility obtained. The exact location and length of each step determines the whip and flexibility of the club, and varies. However, the machines are so designed that step length and diameter may be changed quickly and easily, thus permitting quantity production combined with quality on almost a job basis. These machines are hydraulic presses under precision control. (Fig. 2.)

On leaving the stepping press all shafts advance to the tempering furnaces. (Fig. 3.) These are also specially designed, electrically heated units operating under automatic temperature control, Leeds & Northrup controlling and recording potentiometers being used. To avoid any possibility of decarburization of the thin-walled shafts, furnace atmosphere is controlled at all times, and when the shafts are brought to temperature they pass automatically to the quenching bath without being exposed to the air at any time.

After quenching all shafts are reheated to the proper temperature to give exactly the right temper to each type of shaft in electrically heated furnaces under close automatic temperature control. True Temper shafts are straightened during this operation, being charged into specially designed press racks which are built into one of the final tempering furnaces.

The shafts are now ready for the final finishing, but before advancing to the plating tanks each shaft is put through a series of tests, designed to find even the slightest sign of a flaw, for the

(CONTINUED ON PAGE 70)

Capital Goods Index Rises Sharply

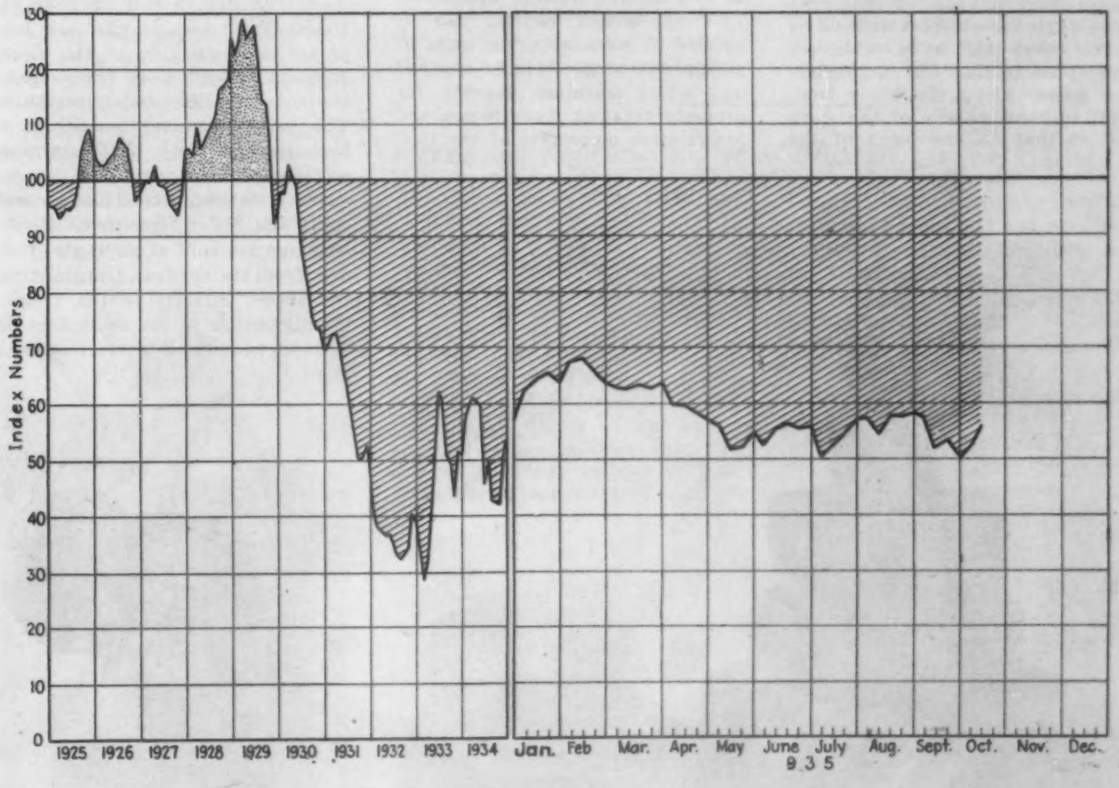
HEAVY industrial improvement was not widespread last week, but its influence dominated the capital goods field from a collective standpoint. Consequently, THE IRON AGE index rose 3.1 points, despite the weakened positions of steel production and lumber shipments. Expanding automotive operations and construction activity jointly featured the rise, though the latter's influence was the heavier. While estimates with respect to the Pittsburgh district are subject to revision, it is felt that operations there have not completely overcome the effects of the coal strike.

THE IRON AGE Weekly Index Numbers of Capital Goods Activity

(1925-'27 = 100)

Last week (est.)	56.0
Preceding week (rev.)	52.9
Same week last month	51.6
Same week 1934	42.5
Same week 1933	51.3
Same week 1932	33.5
Same week 1931	52.0
Same week 1930	76.2
Same week 1929	112.1

At this point, THE IRON AGE cumulative index shows that, with respect to the rate of activity in the base period, 1935 is the equivalent of approximately two weeks' production ahead of 1934 and more than five weeks ahead of 1933. In fact, production during 1935 to date has already exceeded that for the entire year of 1933.



(1925-27 Average = 100)

The Iron Age Index of Capital Goods Activity. The years 1925 to 1934 are plotted by months, the current year by weeks.

Components of the index: Steel ingot production rate, from THE IRON AGE; revenue freight carloadings of forest products, from Association of American Railroads; automobile production, from Cram's Automotive Reports; heavy construction contract awards, from *Engineering News Record*; index of productive activity in Pittsburgh district, from Bureau of Business Research of University of Pittsburgh.

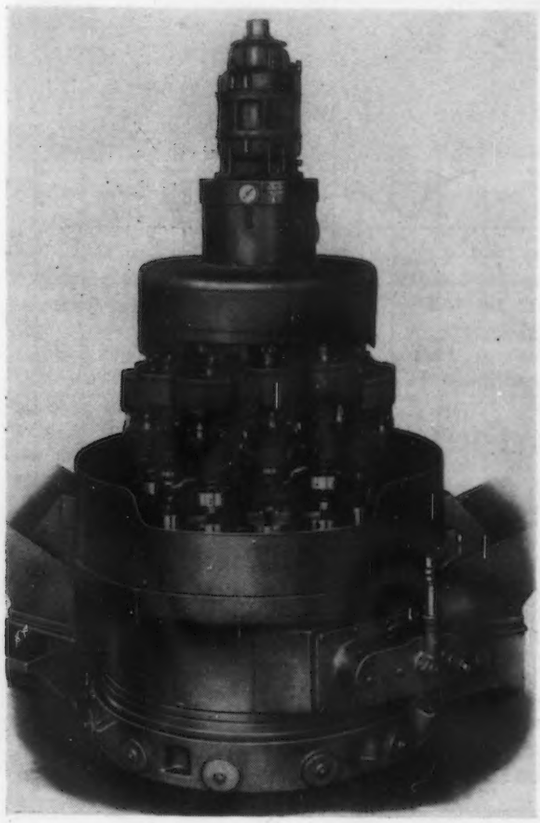
Improvements in Production

Roto-Broaching Simultaneously On Internal and External Surfaces

THE definition of "Roto-Broaching," as offered by The Bullard Co., Bridgeport, Conn., makers of the Bullard roto-broach equipment is—subjection of the work while rotating at cutting speeds to the action of the tool, the blade edge or edges of which are arranged to approach the work surface (either internal or external) at an angle with respect to the axis of the work and at a relatively slow speed so that the cutting action passes along the blade from point to point axially of the work and so that no one point of the blade is subjected to continuous strain or a continuous heat for an excessive time interval.

It is pointed out that a multiplicity of work pieces may be both roughed and finished at one setting and by a single pass of the tool or tools involved in the production use of this modern Bullard equipment. The roto-broach method can be applied to manufacturing units of multiple or single spindle types if and when machines provide for properly rotating work pieces and for relative movement of the tool.

Internal and external operations may be carried on simultaneously by dividing the types of operations among multiple spindles.



AT LEFT

SET-UP possibilities with respect to types of operations on a single workpiece serve to promote a habit of completion at one setting.

o o o

AT RIGHT

IN this new model press each element is positioned for the avoidance of interference at any angle of operation.

Characteristic Feature Retained in New Press

IN its new 1¾-in. inclinable press, illustrated below, the Niagara Machine & Tool Works, Buffalo, features the 14-point engagement sleeve clutch described in THE IRON AGE of July 18, page 44. Double-V adjustable gibs are employed on each side of the slide. Niagara breech-block die clamp supports the die under pressure. The back gears are located in a high position with shaft running on Timken bearings. The 1¾-in. diameter forged, turned and ground shaft has 3¼-in. eccentric. Shaft bearings are split at an angle of 45 deg. from the vertical, transmitting the thrust directly to the frame. Compensating brake equipment is marked to indicate correct adjustment.

and Shop Equipment . . .

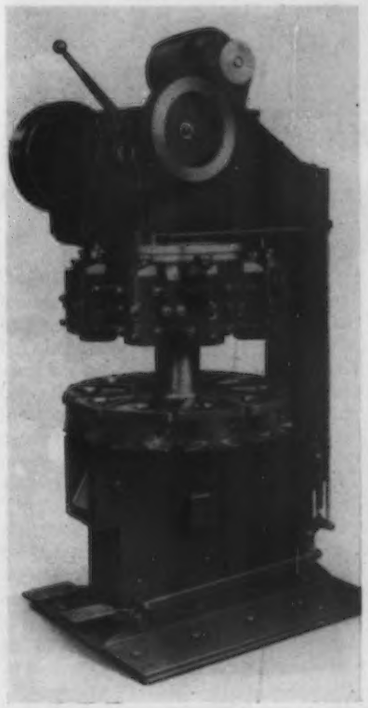
Punch Press Has Rotating Turret With From Six to 12 Tool Slides

A MULTI-TOOL punch press that differs from the usual punch press in that it has a rotating turret containing from six to 12 slides or tool stations, according to size, has been placed on the market by the Schatz Mfg. Co., Poughkeepsie, N. Y. The frame of this unique new machine, which is here illustrated, is made of rolled steel plates, which construction is said practically to eliminate spring in the frame, as well as eliminating breakage.

Turret rotation is power-actuated from the main drive. By depressing the left-hand foot treadle the desired tool is brought into working position. The bed and the tool surfaces are liberally dimensioned for attaching punching, shearing, pressing, bending, straightening and forming tools. The upper tools have vertically adjustable guides, the adjustment for which is said to be so ample that the tools can be lowered sufficiently close to the lower dies to avoid in many cases the necessity for strippers.

Another advantage emphasized is the provision for lowering the upper tool on to the work. For this the machine is equipped with a pilot lever that also serves rapidly to set or match the tools. It is stated that not only is the fastening of the tools very simple but due to the method of attaching them, tool costs are reduced considerably, particularly for the upper tools.

The machine is built in five sizes, with ram pressures ranging from 17 to 130 tons and with throat depths from 8¾ in., for the smallest size, to 14¾ in., for the largest size. Strokes per minute range from 100 to 75, according to size. The drive from the motor is by multiple V-belts.

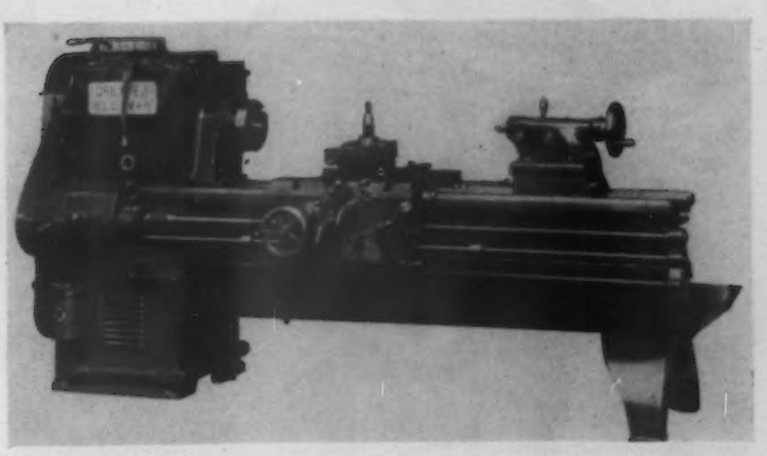


Ten tool stations are illustrated.

Increased Rigidity in New Model Engine Lathe

THE spindle is free from any sliding gears or clutches in the headstock of a new Timken equipped, geared-head engine lathe offered by Greaves-Klusman Tool Co., Cincinnati. The arrangement of gears within the head involves one lever for disengaging friction, relieving the gearing of all strain and permitting two other levers to be utilized in the sliding of gears into any of twelve selective speeds. The design is similar to sliding gear transmission employed in automobiles. A bed extension is provided in back of front end and acts as a support between the headstock and the front cabinet leg. The spindle center is back of the center line of the bed.

Additional turning capacity and strength are obtained by a rear V, dropped to the level of the front flat. The apron is of box type and provides double support for all shafts. The apron front is removable for inspection within.



Design provides that tool pressure angle shall react inside the front-V.

Automatic Miller Has Integral Cam Housing

KENT-OWENS MACHINE CO., Toledo, Ohio, have brought out a new No. 26 automatic milling machine which has a cam housing cast integral with a slide on the knee. The cam is laid out for a particular operation. Design provides for disengagement of the cam so that the table may be put through its cycle of operations by hand in setting up.

The spindle is mounted on Timken precision taper roller bearings front and rear. New standard spindle nose and taper with 1 1/16 in. clearance hole through is used. Any single spindle-speed can be used for constant speed motor drive. Countershaft drive provides two speeds, 73 and 164 r.p.m. with standard pulleys and countershaft operating at 200 r.p.m. Three to five hp. motor drive is recommended for average conditions. Table working surface is 36 in. long x 8¼ in. wide; table overall 43 x 14 in. There are three 11/16-in. T-slots on 2⅛-in. centers. Capacity range is specified: Center of spindle to table 0.0 in. min., 15½ in. max. Center of table to spindle nose, 7 7/16 in. min., 11 15/16 in. maximum. Center of table to spindle nose, 7 7/16 in. min., 11 15/16 in. max. Cross saddle feed 4½ in. Vertical feed of head 6½ in. Table travel by cam 10 in. max. Net machine weight, 2900 lb.

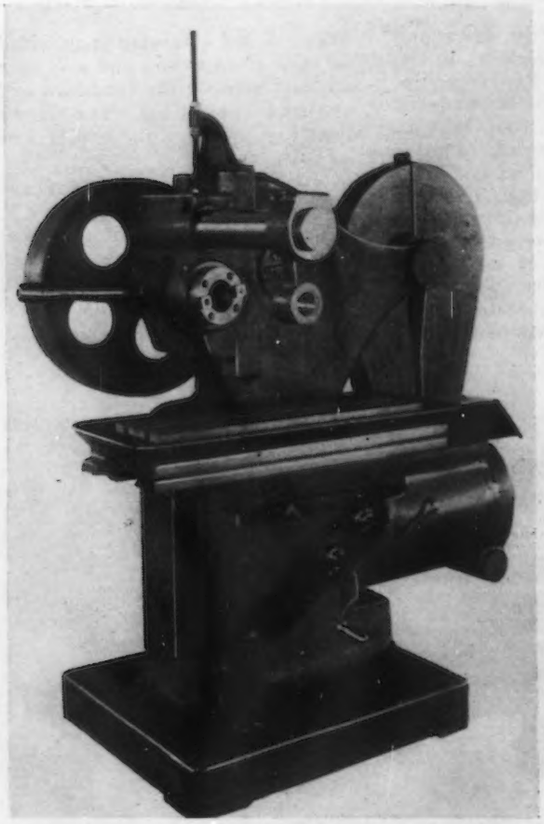
Improvements in New Turret-Head Nibblers

GRAY MACHINE CO., Philadelphia, has added two turret-head nibblers, 18-in. throat, ¼-in. capacity, and 24-in. throat, 3/16-in. capacity, completing a line of 11 sizes and capacities. The new machines are illustrated below. A new feature is said to eliminate all chatter and vibration of the strippers. It consists of a weighted screw adjustable so that the weight can be kept just past the center when the screw is tight against the shank of the stripper. Any impact vibration from the cutting tool only tightens the screw against the shank. Heretofore lock nuts have been required and their use has involved frequent tightening. The design of the new machine includes a tool-lubricating oil reservoir with channel directly to the cutting tool. The flow of lubricant to the cutting tool is uninterrupted regardless of position of turret.

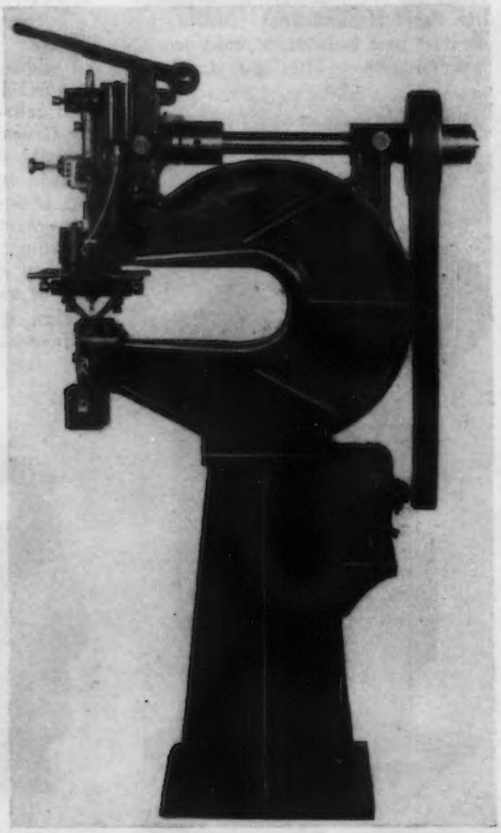
Brinell Machine Plain Or Dial Featured

A POWER driven machine built by Detroit Testing Machine Co., Detroit, for hardness testing in production fields, eliminates both

spotting and stops for readings. Operation is by foot treadle leaving the operator's hands free for parts handling. The direct read-



Cam-controlled selective cycle of automatic table feed makes for production economy.

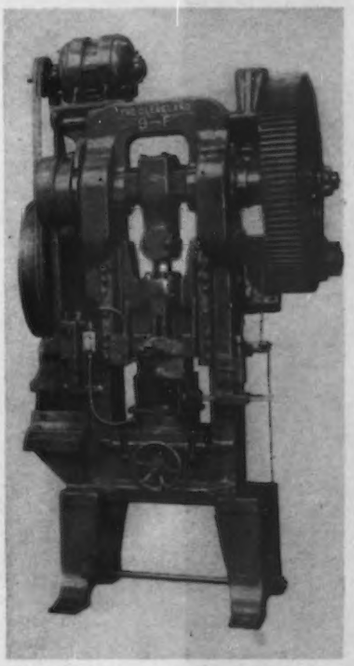


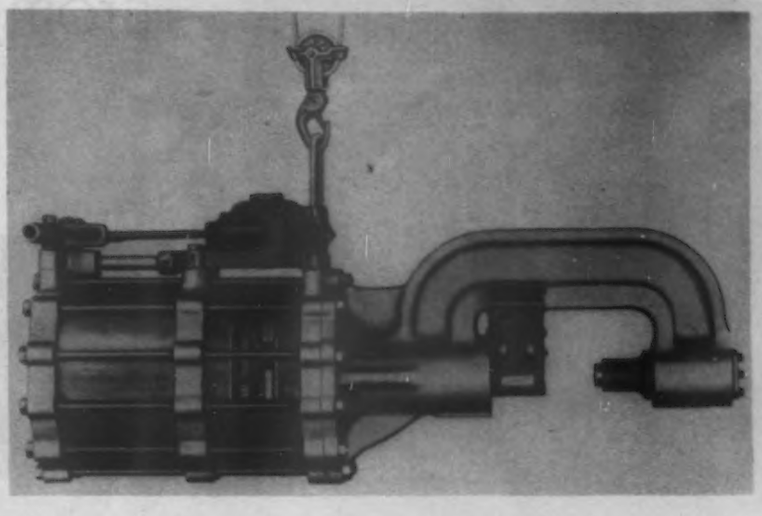
Lost stripper motion is overcome by a weighted adjustable screw mechanism.

ing device is so mounted as to be free from machine frame deflection and can be employed in testing round, flat or odd shapes. If work requires only a plain motor driven Brinell the direct reading feature is not required. Adjustability for work handling provides ample support for small parts. The frame is a one-piece box casting. The equipment is built in two sizes, 6 x 12 and 9 x 18-in. work gap.

Trimming Presses for Upsetting Test Pieces

TRIMMING presses, built by the Cleveland Punch & Shear Works Co., Cleveland, and designated as 9-F, are here illustrated. With V-belt, motor drive operation is at 65 strokes per minute. The equipment has been designed for upsetting test pieces through the following procedure: Cut to proper length on the side shear which has full hole shear blades and adjustable back gages. After being cut, the pieces are set on end under the inner slide where they are held in upright position by means of a magnet block which has handwheel adjustment for size of test piece. This adjustment is at the front of the press, adjusts the magnet back to the proper height and is so designed that each notch on the dial of the magnet registers one thousandth of an inch. A positive lock is provided. Major adjustments are also taken care of in the slide. The entire mechanism is boxed in a safety door preventing operation unless the door is closed.





Portable Pneumatic Pressing Equipment

ALTHOUGH developed for pressing spring shackle bushings and pins in automobile chassis frames, the portable pneumatic press here illustrated, a new product of the Hanna Engineering Works, Chicago, is said to be finding general application for pressing, punching, riveting, upsetting and marking operations.

The press shown is tooled for pressing shackle bushings in chassis frames. Equipped with a hopper feed for the bushings, the operator need only locate the index pin in the chassis frame, operate the valve trigger and the bushing is driven in at a predetermined pressure.

Two cylinders separated by a diaphragm not only make for compactness, but are said to effect savings in air consumption. Extensive use of aluminum alloy castings has resulted in light weight, the machine weighing 135 lb. In use, the press is suspended from a balancer. Yokes are usually designed to fit the job, but standard yokes of varying reach and gap are available. The equipment is built in 3, 4 and 5-ton capacities.

Machine Vise Screw-Action Seats Work

IN a machine vise, announced by C. R. Gier Co., 75 West Street, New York, the application of downward gripping pressure, by mechanical means, avoids the use of external tapping force in gaining a solid seat for vise-held work.

In tightening the vise screws, directional pressures are developed which insure that the work piece shall rest squarely upon the base or work-holding members. This pressure application is featured as of special advantage in work requiring accurately parallel or angular surfaces. Component parts slide on guides and carry jaws. The downward pressure is developed as the jaws begin to grip the work. The operating mechanism is fully inclosed.

The vise is available in "halves." The positioning of the halves on a machine table permits sufficient separation to meet the requirements of long work. Two movable jaws may be employed in each half in order that work may be clamped at each or either end.

From Slab to Strip Continuous

AT LEFT

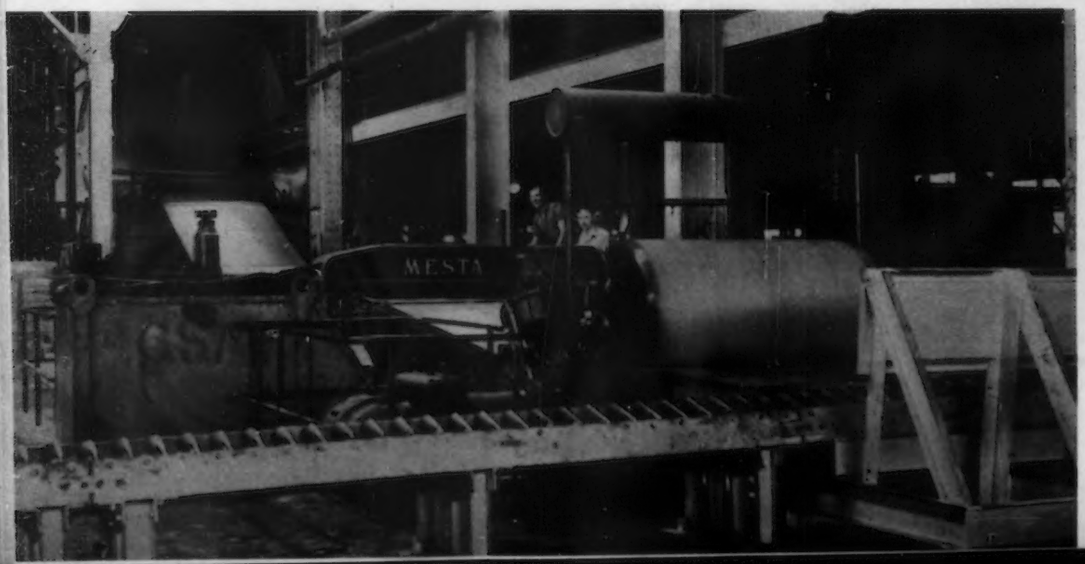
TWO of the four new four-high roughing mills of the Youngstown Sheet & Tube Co. A slab, 10 to 12 ft. long and 6 in. thick and weighing 2000 to 15,500 lb., is broken down to a thickness of approximately 1 in. Monthly capacity is about 60,000 tons.

o o o

AT LEFT

THE 1-in. slab from the roughing mills passes through these six, four-high, 79-in. finishing stands at from 900 to 1450 ft. per min. At the discharge end the original slab has been elongated to about 500 ft. and reduced to 1/8 in. in thickness.

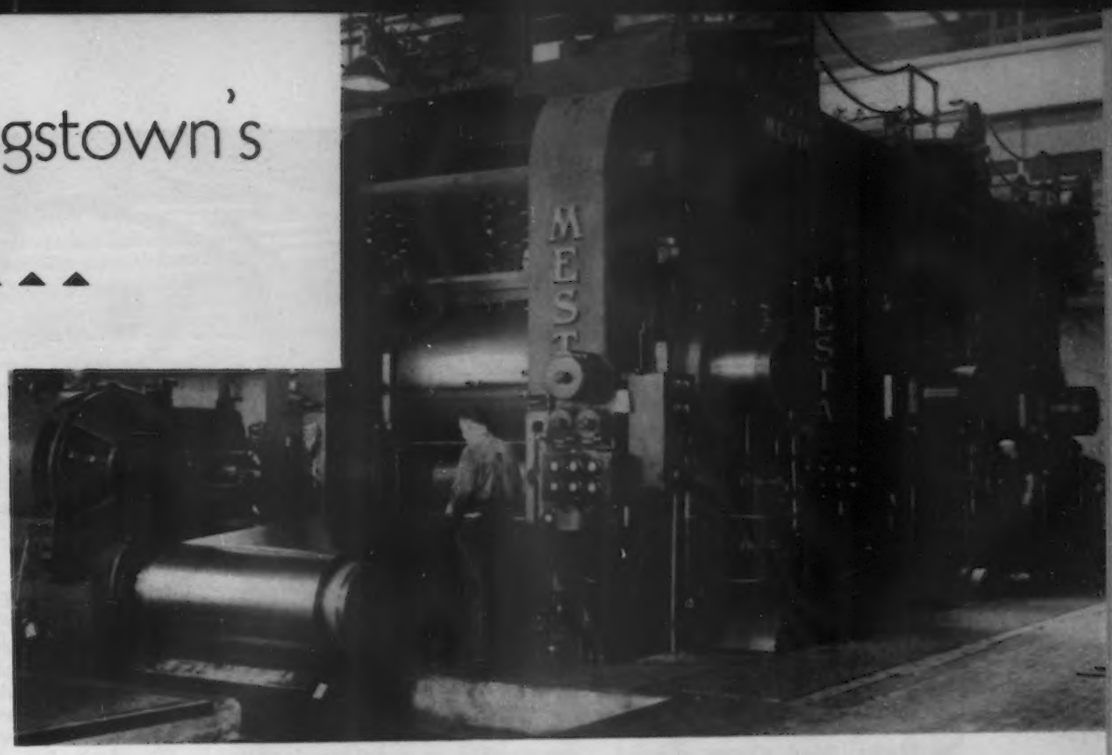
o o o



AT LEFT

COILED strip from the hot mill is unwound and flattened, the ends are trimmed and individual coils are mechanically stitched together. This never-ending strip of steel passes at a speed of about 80 ft. per min. through a 350-ft. continuous pickler, of which this is the delivery end. The stitches connecting the individual coils are cut out by the shear in the center.

in Youngstown's Mills ▲▲▲



AT RIGHT

THE coils are then passed through this three-stand, four-high, 79-in. continuous cold mill at the rate of 150 to 200 tons per 8 hr. This unit effects an elongation of the original slab to 1200 ft. and reduces the gage to 50/1000 in.

o o o

AT RIGHT

FOLLOWING the cold mill reduction, the coiled strip passes through this machine wherein the strip is cut to desired widths by a side shear, roller leveled and then cut to desired lengths by a flying shear. Sheets designed for stamping or forming are then box annealed to impart the desired temper and drawing qualities.

o o o

AT RIGHT

AFTER annealing, the strip (or sheet) is given a skin pass through this single stand of rolls to perfect surface qualities and relieve strains, and is again roller leveled. After testing and inspecting, the steel is ready for shipment.

NEWS OF THE WEEK

Steel Corporation Increases Daily Rate of Shipments in September

STEEL shipments of the United States Steel Corpn. totaled 614,933 tons in September, compared with 624,497 tons in August and only 370,306 tons a year ago.

The company's September rate of shipments was sufficient to engage its finished steel-making facilities at 39.7 per cent of capacity as against 37.3 per cent during August. This was because September contained two less working days than August.

MONTHLY SHIPMENTS OF STEEL PRODUCTS BY UNITED STATES STEEL CORPN.

Month	1930	1931	1932	1933 Shipments	1933 Per Cent of Capacity	1934 Shipments	1934 Per Cent of Capacity	1935 Shipments	1935 Per Cent of Capacity
January	1,104,168	800,031	426,271	285,137	17.7	331,777	19.8	534,055	31.9
February ...	1,141,912	762,522	413,001	275,929	18.5	385,500	26.3	583,137	39.2
March	1,240,171	907,251	388,579	256,793	15.3	588,209	36.6	668,056	41.5
April	1,188,456	878,558	395,091	335,321	21.6	643,009	41.5	591,728	36.7
May	1,203,916	764,178	338,202	455,302	27.1	745,063	44.4	598,915	35.8
June	984,739	653,104	324,746	603,937	37.4	985,337	61.2	578,108	36.7
July	946,745	593,900	272,448	701,322	45.1	369,938	23.0	547,794	34.0
August	947,402	573,372	291,688	668,155	39.8	378,023	23.1	624,497	37.3
September ...	867,282	486,928	316,019	575,161	35.6	370,306	23.0	614,933	39.7
October	784,648	476,032	310,007	572,897	35.5	343,962	20.6	.....	...
November ...	676,016	435,697	275,594	430,358	26.7	366,119	22.9	.....	...
December ...	579,098	351,211	227,576	600,639	38.7	418,630	26.1	.....	...
Plus or minus yearly adjustment ..	(40,259)	(6,040)	(5,160)	(44,283)	...	(19,907)	...	.....	...
Total for year	11,624,294	7,676,744	3,974,062	5,805,235	30.1	5,905,966	30.6	.....	...

Cites Aluminum and Steel Competition

ALUMINUM and steel are now in direct competition and the development of the new low alloy steels has resulted in a keener competition of the two metals in the transportation field. This was pointed out by E. H. Dix, chief metallurgist, Research Laboratories, Aluminum Company of America, in an address on competition among metals, at the initial meeting of the season of the Cleveland chapter of the American Society for Metals.

In its broadening growth, aluminum has had its influence on other metals, Mr. Dix said. During the depression terrific pressure was exerted by manufacturers of metals to find new outlets for their product. There has been a tremendous increase in the use of aluminum for store fronts, spandrels and for other building construction work. Strong aluminum alloys, he said, have gone far to replace steel for motor buses and trucks and free-cutting aluminum alloys are now able to take their place with brass and steel for screw machine parts.

The Cleveland and Pittsburgh chapters will hold a joint special meeting in Youngstown, Oct. 17. The plant of the Youngstown Sheet & Tube Co. will be inspected in the afternoon and in the evening Robert S. Archer, chief metallurgist, Chicago district, Republic Steel Corpn., will address the two chapters on "Metallurgical Developments."

Milne To Represent U. S. S. Alloy Steels In New England

A. MILNE & CO., 141 Milk Street, Boston, have been appointed sales agents in New England for alloy steels produced by the Carnegie-Illinois Steel Corpn., subsidiary of the United States Steel Corpn., effective Oct. 1.

For almost 50 years A. Milne & Co. have been serving a large clientele as merchants of iron and steel. The original partnership was established in 1887 by Alexander Milne and Luther Little, both of Boston. Almost simultaneously with the opening of the Boston business there was also established a like service in New York.

In 1892 James K. Hoyt was admitted to partnership. Mr. Milne died in 1915 and the business was carried on by the surviving partners until 1926 when Henry Sears Hoyt and J. King Hoyt, Jr., sons of James K. Hoyt, were admitted to partnership. Control of the business was assumed in 1927 by Henry Sears Hoyt and J. King Hoyt, Jr., who remain the sole partners in this enterprise which will celebrate its fiftieth anniversary in 1937.

British Steel Production at Highest Level Since October, 1929

LONDON, Oct. 14.—(*By Cable*)—Pig iron consumers are trying to secure deliveries six months ahead, but sellers are limiting sales to early deliveries, owing to the possibility of higher prices.

Small imports of semi-finished steel are insufficient to affect demand for British material and makers of mild steel billets are experiencing difficulty meeting requirements.

Finished steel is being well specified. Prospects are brighter for rollers of shipbuilding material. The motor and engineering trades also provide steady support and important bridge building contracts are anticipated soon. Exports are moderately active and a big cargo was shipped to Argentina.

September production of steel ingots and castings was 856,000 tons, the highest since October, 1929.

Because of recent heavy buying of Welsh tin plate and persistent demand for early shipments the International Tin Plate Control Office is refusing United Kingdom mills export permits in all markets for shipment before January.

The Argentine Government is inquiring for galvanized sheets for locust barriers. Continental iron and steel markets reflect improvement in export business due to fear of higher prices and belated commencement of autumn buying. Most business is with Scandinavia, Egypt and South America, but revival in the Far East is reported. China has bought bars and Japan semi-finished steel.

The Brussels meeting of the International Steel Cartel discussed details of agreements with England and international control of thin sheet exports. The Anglo-Continental agreement is reported to have fixed extras on selling prices of cartel products.

British Prices, f.o.b. United Kingdom Ports

Per Gross Ton

Ferromanganese, export	£9
Billets, open-hearth	£5 10s. to £5 15s.
Tin plate, per base box	*18s. 2d. to 18s. 7½d.*
Steel bars, open-hearth	£7 17½s.
Beams, open-hearth	£7 7½s.
Channels, open-hearth	£7 12½s.
Angles, open-hearth	£7 7½s.
Black sheets, No. 24 gage	£9 5s.
Galvanized sheets, No. 24 gage.	£11 5s.

*To Jan. 1; 18s. 3d. to 18s. 10½d. thereafter.

Official Continental Prices, f.o.b. Continental Ports

Per Metric Ton, Gold £

Current dollar equivalent is ascertained by multiplying gold pound price by 124.14 to obtain franc equivalent and then converting at present rate of dollar-franc exchange.

Billets, Thomas.	£2 7s.
Wire rods, No. 5 B.W.G.	£4 10s.
Steel bars, merchant	£3 5s.
Sheet bars	£2 8s.
Plate, ¼ in. and up	£4 2s. 6d.
Plate, 3/16 in. and 5 mm.	£4 4s. 8d.
Sheets, ¼ in.	£4 9s. 8d.
Beams, Thomas.	£3 2s. 6d.
Angles (Basic)	£3 2s. 6d.
Hoops and strip base	£4 2s. 6d.
Wire, plain, No. 8	£5 7s. 6d.
Wire nails	£5 15s.
Wire, barbed, 4 pt. No. 10 B.W.G.	£8 15s.

Hook Succeeds Verity On Institute Committee

THE directors of American Iron and Steel Institute have elected Charles R. Hook, president, American Rolling Mill Co., Middletown, Ohio, as a member of the executive committee of the board, succeeding George M. Verity, who has resigned as a director.

Donald B. Gillies, vice-president, Republic Steel Corpn., Cleveland, has resigned from the board.

Mackintosh-Hemphill Will Reorganize

APPLICATION was filed on Oct. 10 in the Federal Court by the Mackintosh-Hemphill Co., Pittsburgh, for authority to reorganize under the provisions of Section 77B. In a statement following the action, Col. J. S. Ervin, president of the company, said:

"All plants of the company are operating at substantially full capacity and on a profitable basis, but reorganization seems advisable in an effort to adjust certain mortgage and other liabilities and to protect fully the customers, employees, creditors and stockholders of the company."

The Mackintosh - Hemphill Co. has been in continuous existence since 1803. At the present time it employs approximately 1000 persons, 700 of whom are in the Pittsburgh district. It has plants at Pittsburgh and Midland, Pa., and at Wooster, Ohio. It designs and builds rolling mill and finishing machinery, and casts rolls.

Armco Buys Calco Iron Pipe Co.

THE American Rolling Mill Co., Middletown, Ohio, has acquired the assets of the Calco Iron Pipe Co., Ltd., West Berkeley, Cal., for which it has exchanged 72,500 shares of its common stock.

The Calco company owns the Corrugated Culvert Co., manufacturer of spiral weld pipe. The American Rolling Mill Co. and Calco have had mutual business interests for many years with development of the spiral weld pipe business carried on simultaneously and in close cooperation.

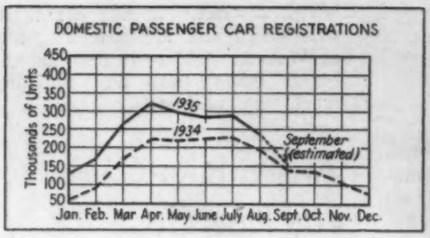
H. W. Force, founder of the Calco companies, will continue as managing executive of the Western branches.

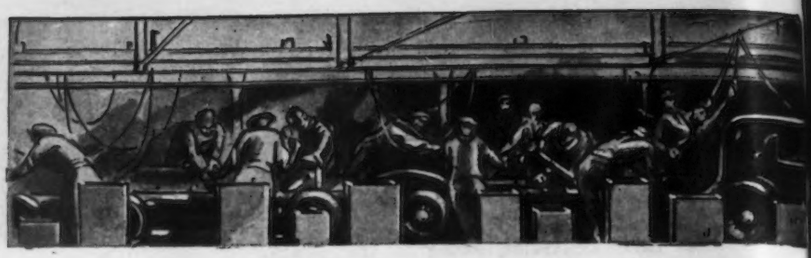
American Rolling Mill Co. has applied to the New York Stock Exchange for listing of the 72,500 additional shares of common stock. At current market quotations, the stock paid for the Calco company assets is worth approximately $1,800,000.

Form Refractories Sales Organization

THE National Refractories Co., Inc., has been organized as a sales corporation, handling the products of M. D. Valentine & Brothers Co., Woodbridge, N. J.; Haws Refractories Co., Johnstown, Pa., and Mexico Refractories Co., Mexico, Mo. The company's headquarters are at 1520 Locust Street, Philadelphia, with branch offices at New York, Pittsburgh and Cleveland.

Officers of the company are: Roger A. Hitchins, president, who formerly was president of the American Refractories Institute; Park Hitchins, vice-president, who also was previously associated with the refractories institute; John R. Sproul, vice-president, who formerly was president of General Refractories Co. and who for the past two years was associated with Harbison Walker Refractories Co. at Philadelphia; Felix McManus, vice-president in charge of traffic and railroad sales; Z. Bresser, secretary. James M. Austin has been appointed district sales manager for the Pittsburgh territory, including Ohio, with headquarters at 610 Oliver Building, Pittsburgh.





THIS WEEK ON THE

Minor Changes Featured on Most of the 1936 Models

DETROIT, Oct. 15.

DETROIT has worked itself into the customary state of excitement which exists on the threshold of a new model season. Sales executives are scattered around the country holding dealer "pep" meetings, factory managers are endeavoring to push up production sufficiently that all retail outlets will be supplied with cars at announcement time, and publicity writers are turning out reams of ecstatic descriptions of 1936 cars.

The truth is that the changes from 1935 design are so few that sales departments are having to dig deeply to find anything new to talk about. The outstanding characteristic of 1936 cars is that most of them look as though they had been made from the same pattern. In fact, if one gets a side view of them, they so closely resemble the past year's design that the average person couldn't tell the two apart. Only a head-on view enables one to identify one car from another.

One major executive, President H. J. Klingler of the Pontiac Motor Co., has the courage to tell the public the truth. He confesses that "the upturn in general business, which has given the automobile industry its best year since 1929, is a natural impetus which will carry the sale of cars to greater heights in 1936 without the necessity for basic changes in design at this time. The greater our national prosperity, the smaller the necessity for radical engineering change."

Whatever changes have been made in outward appearance have principally been confined to the radiator grille and hood louvres, with some cars switching over to the all-steel top. The popular trend is toward narrowing the radiator and rounding it with a vertical grille, after the mode set by Oldsmobile. In several cases (including Pontiac and Hudson) the grille has sweeping vertical lines in the middle, offset by horizontal lines at either side. Louvres generally are changed just enough in shape to call them new.

Interiors of bodies are longer and wider. The emergency brake has been moved from the driver's right to his left or to the "dash," leaving the center of the front compartment free from obstructions and giving more space to passengers. Better upholstery is being used, Chrysler in particular making a point of "dressing up" the interiors of its various cars. A touch of color has been given to knobs, handles and trimmings inside the cars through employment of plastic molded products rather than steel.

Cars are heavier, the increased weight ranging from 50 to 175 lb. In some lines, such as Pontiac, the added weight is largely in the frame. Where a change-over has been made to the steel top, the weight has gone up. Most cars today are 250 to 400 lb. heavier than they were two or three years ago.

Synthetic Enamels Gain Favor

There is a definite swing away from lacquer to synthetic enamel for automobile bodies for 1936. Ford started the movement two years ago when it adopted alkyd resin enamels or "glyptal enamels" in which soy bean oil is used. Plymouth recently has been converted to synthetic enamels and all its 1936 bodies will be painted with them. It is understood that Dodge may go to synthetic enamels, which have proved exceptionally durable in service. Even Fisher Body is said to have been investigating this development closely.

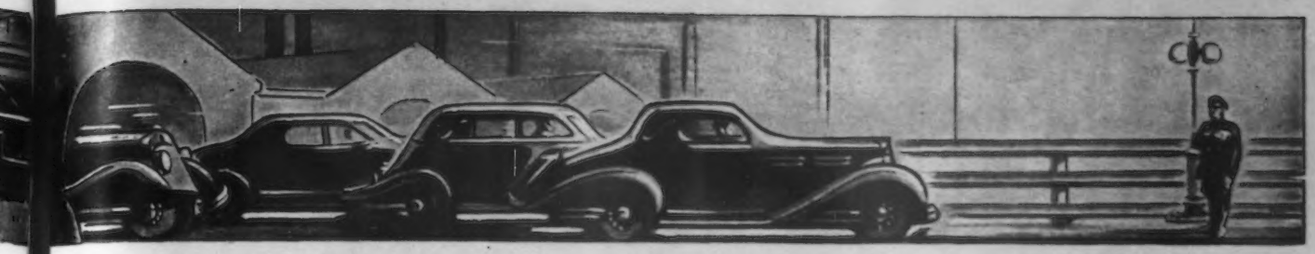
Independent springing will neither gain nor lose. All General Motors cars, except the Standard Chevrolets and Standard Six Pontiacs, will have "knees." On the Master Chevrolet they still will be called optional, but try and get one without them (and without paying extra for them). Packard 120 and the Chrysler and De Soto Airstream series will continue to have coil springs.

Aluminum pistons, given an anodic treatment to prolong their wear, have been adopted by Oldsmobile and Buick. Chrysler divisions have been putting aluminum pistons through an anodic process since early in 1935 and will continue the practice the coming year. Cadillac-LaSalle has been doing this for a year or more.

Pontiac Has New Pistons

The new alloy cast iron pistons for Pontiac contain 0.15 to 0.20 per cent of nickel and 0.15 to 0.25 per cent of chromium. The total carbon content is 3.30 to 3.55 per cent and the combined carbon, 0.50 to 0.60 per cent. The wall thickness when the piston is finished is 0.040 to 0.050 in. The weight is 1.52 lb. on a six-cylinder job, the piston being 3 5/16 in. in diameter. While there has been no change in the general foundry set-up for producing the thinner-walled pistons, greater care is necessary in preparing the molds.

The steel top has gained more



ASSEMBLY LINE

converts recently. All Chrysler cars except Plymouth will have it in the form of a welded insert. Reo and Graham-Paige also have been added to the list. Reo remarks that its steel roof panel "is so constructed as to serve as a highly efficient radio antennae and is insulated and fitted with a lead wire for this purpose." Studebaker too is reported to have joined the steel roof adherents. General Motors, Nash and Hudson were among the first advocates of the steel roof.

Those who have adopted steel tops can muster some powerful arguments in their favor.

Steel Tops Take 35,000 Tons of Steel

It is figured that wherever the steel top is used, it represents about 30 lb. more steel per car. With better than a four-million-car year in prospect and well over half of the industry's cars equipped with the steel top, this relatively new outlet for steel will take at least 35,000 tons during 1936.

At the beginning of the 1935 production season, General Motors (and particularly Chevrolet) was the last of the entries to cross the starting line. Both Ford and Chrysler had the jump and benefited materially from it. Early in 1935 the order went out from General Motors headquarters that its cars would be out on time this fall and with plenty of cars in dealers' hands at announcement time or some executive heads would fall. The result is that General Motors today is in the most advantageous position in several years.

Buick had around 13,000 cars in the field when it introduced its new models on Sept. 28, and Pontiac, which will announce its cars next Saturday, has already built over 12,000. Oldsmobile is not formally presenting its cars until Nov. 1 and by that time will have substantial field stocks. Meanwhile, its dealers have been given the word to begin to sell 1936 models

BY BURNHAM FINNEY
Detroit Editor, The Iron Age

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as soon as they arrive. Chevrolet, too, will have ample stocks when the New York show opens. Fisher Body is furnishing bodies to all General Motors divisions in plentiful numbers.

Buick Has 20,000 Orders

On Oct. 10 Buick had on hand 20,000 orders for cars. It is building 750 cars a day and virtually all departments are on two and three shifts, working five days a week. More than 14,000 men are on Buick's payroll, the largest number of the year. By the end of the year Pontiac, which now is making around 700 cars a day, will have built 170,000 cars in 1935, as against last year's production of 81,200 units. Pontiac estimates its recent expenditures as follows: $100,000 for renovating an office building, $370,000 for retooling the sheet metal plant, $500,000 for retooling the motor plant, $150,000 for retooling the sheet metal finishing and assembling plant, $500,000 for renovating the foundry, and $400,000 for body dies.

Plymouth seems a little slow getting under way, parts suppliers in some cases having been asked to hold up shipments. However, schedules should jump sharply in the next two weeks. Plymouth the coming year will have a new type of frame with increased rigidity and strength without adding much to its weight. Depth of side rails and X-brace members has been increased to 5½ in., while box sections at the rear have been extended and those at the front widened. Strength is added at the front by use of a straight crossmember. So-called "shockless steering" will be a feature of the Plymouth, the front springs being pivoted at the rear instead of the front. Each Plymouth will have 400 rubber parts weighing a total of 40 lb. The new cars will be announced Oct. 26.

Dodge apparently has no set announcement date. It is introducing its line in various parts of the country as dealers are stocked. The Chrysler-De Soto factory in Detroit started its assembly lines the past week and will show new cars on Nov. 2. Pierce-Arrow will show new eights and twelves at New York and also will push a 15-passenger luxury highway coach recently put on the market. Nash will have a de luxe series of its 400 line at a base price of $675.

Delay in Ford V-8s

The delay in volume production of the new Ford V-eight has been disappointing to both parts suppliers and the steel trade. The trouble has centered in licking the problem of stamping the radiator shell and grille in one piece and it is intimated that much progress in manufacture of this part is anticipated this week.

Although automotive steel specifications have gained slightly, they are not so large as the trade had earlier expected. In many cases automotive steel users, waiting on releases from motor car companies, are refusing to place steel orders ahead. It appears that they are heading into a period when there is likely to be a grand rush for quick deliveries and somebody is bound to be disappointed. Sheet mills furnishing automotive tonnage are booked at least two weeks ahead and in the next month deliveries are likely to be stretched out rather than shortened.

Fisher Body Corpn. has taken bids on a considerable amount of tool room equipment which will be bought over the next month. Part of the requirements is reported to be for its local die plant, which is the largest in the industry. It is said, however, that equipment will also be bought for other plants in southern Michigan, with the orders being placed by the central office in Detroit.

"That's Bullard Hydro-Shift Vertical Turret Lathe. Some massive construction!"

"You can actually sense that smooth flow of power."

"Its sturdy appearance instills confidence in its rigidity."

"Say! that's a wallopin' husky cut and with all FOUR heads operating too!"

"That machine shows REAL GOOD engineering and construction!"

"Mass weight and proper construction like that assures absorption of vibration."

Echoes from The Show

"No question about reproduced accuracy on that machine."

"See that perfect ease of operation of any function! That's designed for efficiency."

"Imagine that baby to replace the old thing we have."

"Wouldn't that be a humdinger on our heavy jobs!"

"Absolutely practical as well as modern in every respect."

"This proves to me all that Bullard has claimed in their advertising."

"I've never seen its equal for efficiency in Heavy cutting."

56 inch Hydro-Shift

THE BULLARD COMPANY

Bridgeport, Connecticut

Implement Makers Predict Continued Sales

DOMESTIC sales of farm implements are now running 75 per cent of the average for 1928, 1929 and 1930 and foreign sales, though hampered by unstable economic conditions and variable exchange, have climbed to 32 per cent of the same base. This encouraging picture was drawn by W. C. MacFarlane, Minneapolis-Moline Power Implement Co., who addressed the forty-second annual convention of the Farm Implement Institute Oct. 9 and 10. He pointed out that 1934 reached 48 per cent of base and that all conditions now point to the sales curve continuing its upward trend in the coming year.

Backlogs of potential demand remain large and the only encumbrance on manufacturers is the fact that Governmental policies create abnormal conditions which prevent the industry from basing its moves on past experience. Rising costs of labor and materials point to higher equipment prices notwithstanding that wholesale prices in June, 1935, averaged 5½ per cent below June, 1934. Although the industry has been at the problems of standardization and simplification there remains much effective work to be done.

NRA Future Uncertain

The future of NRA is clouded in uncertainty but subsequent action by Governmental heads can in a measure be predicted by present acts and statements, according to F. H. Clausen, president, Van Brunt Mfg. Co., Horicon, Wis. He enumerated these developments as follows: The NRA has been continued and not disbanded; a large force of investigators is busy to determine the extent of violation of former code provisions, particularly wages, hours and working conditions; appeals have been made to former code administrators to report the advantages obtained under their respective codes; the President has asked the leaders of both Houses to be prepared for legislation when Congress reconvenes; announcement has been made that applications for voluntary codes can be made to the Federal Trade Commission with reference of all labor provisions to the National Labor Board and what is left of NRA.

Mr. Clausen recommended that the industry should not anticipate what the program will be and that therefore it should not make application for a voluntary code as some industries are doing. The best and most practical way to cooperate with the Government is for each company management to operate its business in recognition of the standards set up during the past two years. Prove that the industry does not need Government intervention.

The interest of the industry in the public debt is shown by the statement that in 1916 $1 of $12 of the national income was expended by the Government. In 1930 this ratio had been reduced to one to six and in the present year Governmental expenditures, national, State and local, will total more than one-third the national income. No nation can long endure and maintain its credit unless this alarming condition is curbed. Until the large majority of our citizens assume the same attitude toward public debts that they do toward their own (something that must be paid) there is only economic disaster ahead.

OFFICERS OF FARM EQUIPMENT INSTITUTE

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W. C. MacFarlane, Minneapolis-Moline Power Implement Co.

First Vice-President

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P. E. Herschel, Jr., R. Herschel Mfg. Co.
C. A. Hines, Farm Tools, Inc.
H. C. Lisle, John Bean Mfg. Co.
Fowler McCormick, International Harvester Co.
D. C. Selheimer, Massey-Harris Co.
J. S. Witmer, Oliver Farm Equipment Co.
H. T. Leisenheimer, Cleveland Tractor Co.

New Members of Executive Committee

C. R. Messenger, Oliver Farm Equipment Co., chairman.
Charles T. Ray, B. F. Avery & Sons Co., three-year term.
W. D. James, James Mfg. Co., three-year term.
W. A. Zaloudek, Oakes Mfg. Co., one-year term.
H. C. Angster, Chicago Well Supply Co., one-year term.

Honorary Members

J. A. Craig, former president of the Janesville Machine Co.
F. G. Allen, former president, Moline Plow Co.

Sales Depend on Farmer Income

During the years 1924 to 1929, the farmers' net income averaged about 5¾ billion dollars, and during that period, sales of the industry were steadily increasing as the mechanization of agriculture proceeded, according to Harry G. Davis, director of research of the institute. The experience of those years leads to the expectation that when net income is above the five-billion-dollar mark, farmers are able to make liberal purchases of the things they need.

Beginning in 1930, net income began to decline and dropped from about $5,670,000,000 in 1929 to $1,490,000,000 in 1932. The effect of this decline in net income was immediately reflected in sales. From a high of 110 per cent of base (normal) in 1929, the sales curve dropped to 28 per cent in 1932. An increase of approximately $1,200,000,000 in net income took place in 1933, and sales started moving upward, increasing about 1 per cent of the base during that year. A further increase in net income occurred in 1934, and sales went on up to 48 per cent of the base period.

The upward trend in sales in 1934 was more pronounced than was the increase in net income in 1934 as compared to that of 1933. This probably was caused by farmers' renewed ability to buy replacements for the equipment which had become badly worn during the period when their purchasing power was so limited that they were unable to maintain their equipment plant in a reasonably good state of repair. It may also have been partly caused by the increase in individual income which encouraged many farmers to spend reserves which had been carefully

husbanded during the dark days of the depression.

Net farm income for 1935 has not yet been determined but preliminary figures announced by the Bureau of Agricultural Economics at Washington give basis for the belief that it will be at least $300,000,000 greater than in 1934, or somewhere between $3,750,000,000 and $4,000,000,000.

Large Labor Return Now Possible

According to Miscellaneous Publication No. 157, of the Department of Agriculture, the approximate labor requirements for major operations in growing and harvesting an acre of wheat, yielding 20 bushels, was 57.7 man-hours in 1830; 8.8 in 1896, and 3.3 in 1930, when farmers used the most modern equipment available in each of those years. According to Mr. Davis if we assume a selling price of $1 per bushel, or $20 per acre, in each of those years, it is evident that the 1830 farmer received a gross return of 34.7c. for each hour of his labor; the 1896 farmer, $2.27 and the 1930 farmer, $6.06.

There is no surer way for farmers to protect themselves from the direful effects of low prices than by reducing the number of man-hours entering into their production through the use of efficient modern equipment.

Financing Equipment Sales

One problem which has always confronted this industry, and one which still is far from being solved, is that of financing its sales to farmers, Davis pointed out. That it is impossible for farmers to pay cash in purchasing equipment, except in the case of minor articles, is well recognized by everyone familiar with this industry. Extended terms are necessary in the sale of the more costly items such as tractors, combines, grain binders, etc.

The fact that farmers must have credit accommodations in purchasing these larger items, however, does not mean that terms of maturity need be unduly long nor that substantial cash payments should not be required at time of purchase. In fact, it would seem that good business judgment should dictate a definite policy for larger cash payments and shorter terms of maturity.

For many years, it was the general practice in the industry to fix annual maturity dates of deferred payments coincident with crop years and to have them fall due at times when the customer was marketing his major products. This practice, probably, was inherited from the period when farmers' income came in only at the periods when crops or livestock went to market. Whether such due dates are now necessary is quite questionable, and the experiences of many who deal with farmers seem to demonstrate that they are not.

Wider diversification in farm operations, with more frequent marketing of various products, has resulted in a more steady flow of farm income which enables the farmer to make payments on indebtedness at periods of the year which formerly would have been impossible. This changed condition makes it advisable to consider substituting monthly or quarterly payments for annual maturities. Such a practice would be better for the farmer, whose income is derived monthly, because each payment would be smaller and easier to meet, and it would be better for the dealer, whose receivables would be more liquid.

Need for Machine Shop Equipment

A few years ago there was a great deal of enthusiasm among dealers for the installation of well-equipped service stations in connection with their stores. This was one of the best steps forward that has been made in the industry in many years, and it has proved most profitable to all concerned and, particularly, to the dealer who equipped himself to do an expert job of servicing.

All dealers recognize how complete stocks of repair parts keep their customers satisfied and build future sales. A well-equipped service station is capable of doing much more. A satisfied customer is the dealer's best asset, and the best way to keep a machine customer satisfied is to keep his machine in good working order.

State Unemployment Insurance Urged

This is the time for industrialists to study and to start action, within their respective States, on unemployment compensation legislation. The National Security Act, said H. W. Story, vice-president and general counsel, Allis - Chalmers Mfg. Co., will in all probability actually prove to be the stimulus toward rapid building of State systems.

The Federal law provides that the tax shall be collected by the Bureau of Internal Revenue, under the Secretary of the Treasury, and that all money so collected will go into the general fund of the United States Treasury, where it may be subsequently appropriated by Congress for any purpose whatever, even to balancing the budget. This brands the act as a tax measure—a tax on payrolls.

The psychological effect will be that employers will probably prefer to pay into their own State systems, and take credit, if possible, up to 90 per cent as provided in the Federal act, thereby passing only 10 per cent to the Federal Treasury.

There are three courses open to the employer: (1) Wait for a constitutional test of the Federal act; (2) Help to frame a bill for his State, to be conditioned on the constitutionality of the United States act; (3) If the employer is in favor of the Federal act, then he should start at once to help frame a satisfactory law for his State.

In general there are only two true types of so-called unemployment compensation as now existent on statute books. The one is the English or pool type, and the other the Wisconsin or company reserve system. The pool system, as experienced in England, is easily changed to a dole system. Under it the employer with regular employment subsidizes the employer who offers irregular employment. Under the Wisconsin system the State participates only to the extent of administering the plan; it does not own the reserves. Under this system an employer is responsible only for his own employees. No matter what plan is adopted the regularization of employment should be studied and practiced as far as is possible.

Harper Sibley, president, Chamber of Commerce of the United States, said he believed firmly in mechanization of the farm as a forward stride in social advancement not only of the farmer but of the country as a whole. A movement contrary to this advancement, he said, is the action of the Federal Government in its broadening of bureaucratic powers and assumption of States rights. The farmer is admittedly better off today than he was a year ago but this is due far more to natural conditions that have cut surpluses and raised prices than to the AAA, which though set up to meet an emergency, is now a permanent bureau, according to Secretary Wallace.

Contract has been awarded to the Cleveland Wrecking Co., Cincinnati, for the liquidation of all machinery and equipment, and also the demolition of the entire 24-acre plant, comprising 30 large factory buildings formerly occupied by the Baeder-Adamson Paper Mills, who have been operating this mill for the past 107 years. The Baeder-Adamson Co. recently was consolidated with the Minnesota Mining & Mfg. Co., of St. Paul, Minn.

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A. MILNE & CO.

(Established 1887)

141 MILK ST., BOSTON, MASS.

announce

their appointment

as

New England Sales Agents

for

Alloy Steels

manufactured by

CARNEGIE-ILLINOIS STEEL CORPORATION

United States Steel Corporation Subsidiary

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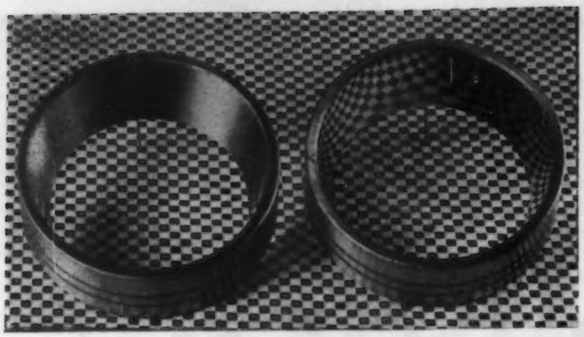

Timken Bearings Given Mirror Finish

AN improved surface finish designated as a mirror finish is being applied to all sizes of bearings produced by the Timken Roller Bearing Co., Canton, Ohio, as rapidly as the necessary special equipment can be built and installed. Longer life, quieter operation, minimum of internal friction, and increased efficiency of lubrication are claimed for this improved finish.

Development of this improved finish dates back 10 or more years. It is stated that improvement in grinding operations on Timken tapered roller bearings had reached a point where no equipment then known could measure the quality of finish. However, some bearings showed different operating characteristics, and research demonstrated that the bearings that ran most quietly had the longest life and were likewise those which had the highest degree of precision.

Research at the University of Michigan, sponsored by the company, resulted in the development of electrical sound testers—a battery of which was installed at the Timken plant to check all precision bearings. These sound testers clearly showed which bearings were best, but still there was no way of measuring the difference between the better bearings. Microscope inspection indicated that possibly some surfaces were smoother than others, but by how much could not then be measured.

Special research to find a means of accurately measuring the quality of finish on the wearing surface of bearings was then undertaken by the company at the University of Michigan, resulting in the development of the Profilograph for measuring surface finish. (For data on this instrument, see Prof. E. J. Abbott's paper before the Society of Automotive Engineers, abstracted in THE IRON AGE of Jan. 31, 1935, page 23.)

Now having a commercial means of measuring surface finish to supplement its electrical sound testing equipment, the company was in a position to still further perfect the surface finish of its product. Special grinding wheels were developed in conjunction with manufacturers of abrasives, and special equipment was designed to use these special wheels. Special grinding coolant also had to be developed.

Oil Drill Pipe Has Integral Tool Joint

A DRILL pipe of advanced design, intended to eliminate the use of the conventional tool joint, has been developed and added to the list of oil country tubular products manufactured by the Jones & Laughlin Steel Corpn., Pittsburgh.

The first step in the manufacture of the new drill pipe, which is designated as J&L integral-joint seamless drill pipe, is the upsetting of the unit to a tool joint shape. After the initial operation, the drill pipe, not yet threaded, is heat-treated to produce the desired physical properties. Then a tool joint thread is cut on the upset end. This provides a tool joint integral with the pipe itself.

An important feature of the new product is the easy change of diameter of the interior, forming a "streamlined" interior, which reduces turbulence and gives increased mud velocity as compared with the standard tool joint with its sharp shoulders.

The box and pin threads of the integral-joint drill pipes are claimed to possess the hardness and wearing qualities of the highest grade tool joint. There is sufficient stock in the upset of both box and pin ends for two complete rethreadings, and, since no heat treatment is required, the rethreading can be done by any shop equipped to cut a suitable thread.

Republic Announces Cleveland Location

THE Republic Steel Corpn. will have its executive and general offices in Cleveland in the Medical Arts Building, one of the Cleveland Union Terminals group of buildings, when it moves its offices from Youngstown Jan. 1. The company has leased approximately 60,000 sq. ft. of floor space, taking over the thirteenth, fourteenth, fifteenth and sixteenth floors, and the name of the building will be changed to the Republic Building, in recognition of Republic's position as the third largest steel producer in the country. The layouts of the floors to be occupied will be redesigned to conform with the company's requirements.

THIS WEEK IN WASHINGTON

Neutrality issue may make 1936 political campaign fodder.

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Defense of constitutionality of Wagner act begins at A. F. of L. convention.

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Reciprocal trade agreement with Colombia reduces duties on a few steel products.

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NRA busy on thorough study of steel industry, despite demobilization plans.

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WPA leaf raking believed to have reached seasonal peak as Army engineers are drafted to straighten out mess.

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BY L. W. MOFFETT

Resident Washington Editor, The Iron Age

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WASHINGTON, Oct. 15.—The spectre of war casts its shadow over "civilization" once more. . . . A weary world, struggling to recover from a depression born of armed conflict, is halted in its efforts, muddling or otherwise, at reconstruction, as it apprehensively wonders if it will be forced again to turn to destruction. . . . Leading it to a morass from which emergence may wellnigh be impossible. . . .

The turn of events may easily shift the highly important domestic economic and political situation to a secondary position to give way to international affairs and the latter may be projected into the Presidential campaign as an outstanding issue. . . . The slogan, "He kept us out of war" reelected Woodrow Wilson, although he did not keep us out of war. . . . But the predominating national will to keep out of war is even greater today than it was in 1916, emphasized as it is by bitter memories of the aftermath of American participation in the war to end wars, to make the world safe for democracy and all that sort of thing. . . . And if the Roosevelt Administration keeps the United States out of war, short of sacrificing national decency, it will find a potent campaign plank if it cares to resurrect the slogan of 1916. . . .

None of which indicates undue alarm that the United States may be engulfed in war. . . . At the same time, the possibilities of involvements are recognized and they will be heightened if the country succumbs to the streams of both imported and home-grown propaganda already pouring forth, some of it ranting, some futilely persuasive, and some of it peppered with harsh names directed at the United States which is accused of "slacking its duty" of "provincialism," cowardice and other such ancient buncombe. . . . The answer to all this is to ignore it, and let the United States look out for itself.

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Labor Front Active

Turning to purely domestic affairs, highlights in developments of the past week centered chiefly around the National Labor Relations Board and the National Bituminous Coal Commission. . . . Appearing before the convention of the American Federation of Labor in Atlantic City, as organized labor took time out from its wordy war over starting its own party, jurisdictional and craft-industrial union questions, Chairman J. Warren Madden of the Labor Board struck back at the American Liberty League for its attack on the constitutionality of the Wagner-Connery labor disputes act. . . . Simultaneously, the board issued its first complaint, charging the Greyhound Lines, Inc., with discharging nine employees because of their union affiliation. . . .

The Bituminous Coal Commission threw its mechanism into gear by issuing a code to which adherence is compulsory on the part of all coal operators, captive mine and commercial alike, under penalty of heavy fines by way of taxation. . . . The coal commission issued its orders governing the election of 23 district boards as the Guffey-Snyder coal act went into effect, and as Chief Justice Wheat of the Supreme Court of the Dis-

trict of Columbia set Oct. 28 as the date for the opening court test of the act. . . . At that time trial will begin on the merits of a stockholders' suit to enjoin the Carter Coal Co. from complying with the act and the Government from enforcing it. . . .

In ordering elections of the district boards, the commission named acting deputy district secretaries to conduct them, elections to be held within 15 days upon receipt of notice of appointment of the secretaries. . . . Setting up of the district boards will precede the establishing of the price structure in the coal industry, or the so-called little NRA whose operations, supporters of the law say, will stabilize marketing and wage conditions. . . . The operation of the act will be watched because of the precedent it may set up for expanding it into a revived NRA covering industry and commerce generally, assuming court permission. . . .

In upholding the constitutionality of the Wagner-Connery act, Mr. Madden's interpretation before organized labor was considerably broader than that given by prior remarks he has made on the new law. . . . The Atlantic City address, in fact, was accepted as a virtual challenge to the widespread opposition in industry to the act. . . . This means the lines are further tightened for the inevitable court test. . . . Mr. Madden pointedly denied that either of the two main attacks on the constitutionality of the act was sound. . . . One charges that it violates the fifth amendment providing that no person shall be deprived of life, liberty or property without due process of law, and the other says it transgresses the commerce clause, denying Congress control over intrastate commerce. . . .

In passing on the first point, Mr. Madden cited Supreme Court decisions, dealing with hours and wages, fixing times for payment of wages, etc., in which he said the court advised that "the mere fact that the law embodies a new idea, or a philosophy with which some people disagree, does not cause it to be unconstitutional." ' . . He also turned to the Supreme Court decision in the Chicago stockyards case to support his declaration that the board does not intend to abdicate, either, to "narrow constructionists" who contend that the act could be applied only to those industries engaged in interstate commerce. . . . He placed an interpretation on interstate commerce and what affects interstate commerce that is much broader than that of opponents of the act. . . . The board, Mr. Madden declared, will determine the breadth of its jurisdiction in the light of facts of the cases before it. . . .

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NRA Demobilizes

Sliding over NRA headquarters, one finds a movement quite contrary to that under way in war-frightened Europe and Africa. . . . For NRA, prodded by Senator King and other unceasing critics, demobilization plans are under way and by Nov. 15 at least 550 of its employees in Washington will be taken off the payroll, according to Administrator L. J. Martin and Maj. George L. Berry, coordinator of industrial cooperation. . . . By that date it is proposed to reduce the personnel of 2800 to 2300 to operate an organization which the Supreme Court has reduced to a mere fact-finding body. . . . The field force consists of about 600 who are making "surveys" and checking on departures by industries from former code provisions, a self-imposed job without legal sanction, and, it may be added, with a great deal of complaint from sections of business and industry. . . . Despite this, however, NRA officials say that the most important work "from now on" will be in the field and that further cuts in the Washington personnel will be made. . . .

Also in the cards is a downward revision of salaries paid the higher-ups in NRA. . . . They may "share the wealth" by increasing the pay of those in the lower brackets. . . . In which event the groaning Federal treasury, always being bled for more and more, would get no relief, not even a grudging dole. . . . Meanwhile unsalaried Major Berry is striving with perhaps strong urging at the hands of organized labor, to bring NRA back into the good graces of industry as he issues some 6000 invitations asking labor and management to attend Washington conferences looking to the setting up of a "permanent structure." . . . This is a forerunner, it is strongly suspected, to a demand for further NRA legislation. . . . Certainly it indicates very clearly that that is what lies back of the move for it is evident that but little confidence is being placed in the voluntary trade practice agreements. . . . Besides, they give the apple to the Federal Trade Commission and leave only the core for NRA. . . .

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AAA Watches Its Politics

Tobogganing to the alpha of alphabetical soup agencies, one finds the AAA-ers with furrowed brows but fixed determination not to ruffle the agricultural voters even at the cost of intensifying the growing storm from consumers. . . . For even as the boiling potato issue sizzles hotter and hotter, AAA prepares a tentative plan to increase the price of the 1935 spud crop at once and in the face of mounting pork prices it intends to leave the pig in the moon. . . . Dealing with the vexing potato control act, AAA has turned to the usual practice of resorting to Government funds to be used for heavy purchases of late potatoes for relief distribution, buying from each producer from 10 to 20 per cent of his crop for distribution through the Federal Surplus Relief Corporation. . . . And since, unfortunately, there are so many on relief, no doubt there will be a ready market, costly to taxpayers but gratifying to growers. . . . The tax control law, which Secretary Wallace once said he would not enforce, and later said he was laughing when he talked of "nullification," affects potatoes dug after Dec. 1, 1935. . . . It calls for a tax of ¾c. a lb. on all potatoes sold in excess of a national allotment, exclusive of the large bootleg crops. . . .

Continuance of corn-hog control is being preached by AAA literature, spokesmen and backers, as preparations are being made for a corn-hog referendum among farmers, Oct. 26, a preliminary to renewal of corn-hog adjustment contracts which expire Nov. 30. . . . The fecundity of the remaining sows of the land has offset somewhat the effect of the wholesale slaughter program and created alarm among regimenters . . . but the latter now appear willing to yield a little to nature and to be ready for an increase in both corn acreage and hog production. . . . The literature sounds a direful warning to the farmers that "without an adjustment program to follow that of 1935, the stage will be set for another upswing in hog production, beginning this fall and reaching its peak in 1938." . . . And then it admonishes against the dangers of low prices. . . . The best bet is that that sort of literature will not be used in the campaign among urban consumers, or among the few pork consumers who will be left at the present mounting costs. . . .

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Leaf Raking Reaches Seasonal Peak

Over at the omega of the alphabetical agencies, a contraseasonal movement has been started by the toppling if not toppled, WPA. . . . With the fall here, the trees are rapidly shedding foliage and it would be expected that WPA would be gaiting itself to fullest activity raking leaves. . . . Instead Admin-

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istrator Harry L. Hopkins, heretofore about the only holdout in the country against the otherwise admitted failure of WPA, now takes a step that smacks of a capitulation. . . . He has done the sensible thing and drafted 11 army engineers, whose records of efficient and constructive planning for sound public improvements cannot by the widest stretch of the imagination be expected to play with boondoggling projects, unless their efforts are interfered with and they are used simply to give the impression that WPA is turning to constructive work. . . . Directing a letter to State works progress administrators, Hopkins has asked them to furnish full information to the army engineers "with particular regard to those obstacles or difficulties which are hampering the program." . . . This concession by Mr. Hopkins that the program is being "hampered," was made known coincidentally with the disclosure of the appointment of Lieut. Col. F. C. Harrington, of the Engineering Corps, as chief of WPA, together with the decision by President Roosevelt that Maj. Gen. E. M. Markham, chief of the corps, will be available as consulting engineer. . . . It was stated that the engineers will report on engineering procedure on construction projects. . . . This looks as though many leaves might be left to rot.

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Colombian Trade Agreement Reduces Some Steel Duties

Colombian import duties on plain and galvanized iron and steel sheets, ordinary tin plate and steel furniture were reduced 33 1/3 per cent by the terms of the American-Colombian reciprocal tariff agreement announced last week by Secretary of State Cordell Hull. These duties were cut from .03 to .02 Colombian pesos per gross kilo.

American exports to Colombia of the sheets and tin plate affected by the reduction amounted to $840,545 in 1929. Steel furniture exports in that year were valued at $417,560. The duties on a wide range of iron and steel products were bound, including tin plate for the manufacture of containers, and cannot be raised for two years after the pact is ratified by the Colombian Congress. Reductions in duties also were conceded by Colombia ranging from 25 to 87½ per cent on copper and brass pipe and fittings.

The agreement also provides reductions of 20 to 25 per cent in the present duties on passenger cars and a reduction of 50 per cent in the duty of trucks and buses.

The present rates of duty have been bound against increase in the case of copper wire and cable, some types of iron and steel pipe and fittings, tin plate for canning; safes, plain steel wire, barbed wire, steel beams, columns, posts, etc., steel chain, nuts, bolts and screws, and a long list of hardware items.

Assurance against tariff increases is to be extended to many items in the machinery group, including textiles, agricultural and wood, metal and stoneworking machinery; telephone, telegraph and radio apparatus; dynamos, motors, transformers and certain other electrical equipment; internal combustion and steam engines and pumps, scales, sewing machines and a number of other mechanical household appliances and sanitary equipment.

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Scope of NRA Steel Study Outlined

In a statement commenting on the NRA steel study, Walter White, industrial adviser, Division of Review, stated that special attention is being devoted to those major problems of the industry which occasioned the President's approval of the code in the form in which it was finally presented to him by the industry. They include the basing point system, standard extras, productive capacity, prices and selling practices, etc. These problems, Mr. White said, will be treated in their natural economic setting and also as they may have been influenced by code provisions.

The study is headed by R. W. Shannon, and as outlined heretofore in THE IRON AGE, includes the following general topics: Corporate structure and control; financial structure and financing methods; nature of competition within the industry; technological progress; employment and earnings of labor; policies and practices with regard to purchasing, distribution and labor relations.

Mr. White pointed out that substantial progress has been made in assembling statistical data which will permit of a rather complete history of labor in the steel industry, together with up-to-date reports on hours, wages and accident records.

"In the field of corporate and financial conditions material has been assembled which will reveal the history of corporate matters and the current corporate condition respecting property, ownership, management and control," said Mr. White. "The field of competition is being studied from the point of view of conditions existing prior to the code, during the code, and to a lesser extent during the post-code period. One of the most interesting situations that arises in the field of competition is between integrated and non-integrated producers."

Sources of information were listed as the NRA files, the Department of Commerce, the Department of Labor, the Security Exchange Commission, the Treasury Department, the American Iron and Steel Institute, the Amalgamated Association of Iron, Steel and Tin Workers, and a number of individual members of the industry.

It was stated that in accordance with the declared policy of the Division of Review the study is being conducted as an objective search for facts and not as an endeavor to obtain evidence in support of any preconceived social or economic theories. A certain amount of basic material, the statement said, will be available by Dec. 1 to the Senate Committee on Finance and the House Committee on Ways and Means, in accordance with the request of the President in communications to Senator Pat Harrison of Mississippi and Representative R. L. Doughton, respective chairmen of the committees, for their consideration in connection with possible legislation at the next session of Congress.

Meanwhile, Major George L. Berry, NRA coordinator for industrial cooperation, is sending out thousands of letters to leaders in management and labor inviting them to conferences in Washington to determine their attitude toward the setting up of a "permanent structure." This is taken to indicate that definite plans are to be formulated, assuming satisfactory response is forthcoming from the invitations, for reviving NRA as an established institution to control trade and labor practices in industry insofar as that is possible since the Supreme Court decision in the Schecter poultry case.

The Allegheny Steel Co., Brackenridge, Pa., has just completed manufacture of what is claimed to be the larget single plate of stainless steel ever made. The plate is 1 in. thick, 231 in. long, 116 in. wide and weighs 7500 lb. The necessary accessories to be used with the plate, such as sheets, bars, tubes and smaller plates, all made of Allegheny Metal, make a combined weight of 12,000 lb. The large plate was rolled from a single 5-ton ingot for which special molds had to be made. The order was placed with the company by J. P. Devine Mfg. Co.

PERSONALS

JAMES L. WICK, JR., president and general manager, Falcon Bronze Co., Youngstown, and a director of the American Foundrymen's Association, has been elected vice-president of the association, to fill the vacancy occasioned by the death of Vice-President B. H. JOHNSON. Mr. Wick has been active in the association for many years, serving on committees and as a director.

Born in Youngstown in 1883, Mr. Wick received his technical training at the Massachusetts Institute of Technology, from which he was graduated in 1906 with a bachelor of science degree in mechanical engineering. During summer vacations he worked in the plant of the William Tod Co., Youngstown, now a unit of the United Engineering & Foundry Co.

Following graduation, he became associated with the Youngstown Sheet & Tube Co., and later with the Natural Light & Thorium Co. as assistant superintendent. In 1908 he became general manager and treasurer, Crystal Ice & Storage Co., and designed and rebuilt its plant. He returned to the Youngstown Sheet & Tube Co. in 1918 for a short time as special agent for claims, and in 1919 became connected with his present firm, the Falcon Bronze Co., as secretary and assistant general manager. He became president and general manager in 1925.

In addition to membership in the A.F.A., Mr. Wick is a member of the American Iron and Steel Institute, American Institute of Mining and Metallurgical Engineers, American Society for Testing Materials and National Founders' Association.

E. H. BALLARD, General Electric Co., West Lynn, Mass., has been elected to the board of directors of A.F.A. to fill the unexpired term of Mr. Wick. The following members of the board were elected members of the executive committee to serve with the president, vice-president, and executive secretary: FRANK J. LANAHAN, Fort Pitt Malleable Iron Co., Pittsburgh; R. J. TEETOR, Cadillac Malleable Iron Co., Cadillac, Mich.; E. O. BEARDSLEY, Beardsley & Piper Co., Chicago; and W. L. SEELBACH, Forest City Foundries Co., Cleveland.

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CLARENCE B. RANDALL, vice-president of the Inland Steel Co., Chicago, and in charge of the company's raw materials and Lake freighters, has been elected a director of the company. He was graduated from Harvard in 1912 and was associated with the Cleveland-Cliffs Iron Co. from that time until he went with the Inland company on Aug. 1, 1925, as assistant vice-president. He was made vice-president in April, 1930.

J. L. WICK, JR.

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F. W. JONES, heretofore vice-president of the Hanover Wire Cloth Co., Hanover, Pa., has been elected president.

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R. M. MARSHALL has been elected secretary of the Woodward Iron Co., Woodward, Ala. He was until recently vice-president and general manager of the Sloss-Sheffield Steel & Iron Co., a position he held for about two years. He succeeds HERBERT SMITH at Woodward. Mr. Smith, because of illness, is now on an indefinite leave of absence after more than 30 years with Woodward Iron.

WILLIAM P. EWING, the report of whose appointment as vice-president of Superior Steel Corpn. was published in these columns on Sept. 26.

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E. B. HARKNESS has been made assistant secretary and assistant treasurer, Carnegie-Illinois Steel Corpn.; J. H. DORNING, assistant auditor, R. W. SMITH, assistant auditor and assistant secretary, W. I. DITHRIDGE, assistant treasurer, and H. G. IRONS, assistant secretary.

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JOHN PRIMROSE, who has been vice-president of the Foster Wheeler Corpn. since it was organized, has been elected vice-chairman of the board, succeeding PELL W. FOSTER, who will continue as director. In 1901 Mr. Primrose became chief engineer of the Power Specialty Co. and subsequently vice-president. When the Foster Wheeler Corpn. was formed, he was made vice-president.

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GEORGE R. WOODS, manager of R. S. Stokvis & Sons, Inc., New York, is sailing for Holland on Oct. 18 on a business trip.

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E. T. WEIR, chairman of the board, National Steel Corpn., will be the principal speaker at the thirty-eighth annual dinner of the Illinois Manufacturers' Association which will be held Dec. 10 at the Stevens Hotel, Chicago.

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T. FRANK WEBSTER, of the Link-Belt Co.'s Philadelphia office, has been appointed resident manager of the Boston office, succeeding HORACE GOLDSTEIN, who has been assigned to engineering and sales work at the Philadelphia office.

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JOHN F. GLENN, who has been identified for the past two years with the Foster Wheeler Corpn., has been transferred to the New York office sales division of the company. For 11 years he was in charge of various sales offices of the Wickes Boiler Co. and for 15 years subsequently was New York and New England sales manager for the Edge Moor Iron Co.

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W. J. GEORGE, for over 18 years associated with the operating and sales department of the Edgewater Steel Co., Pittsburgh, has been appointed assistant sales manager of the company.

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BERT CONWAY, formerly manager of the Chevrolet transmission plant at Toledo, has become identified with the Pontiac Motor Co.

Current Metal Working Activity Statistically Shown

These Data Are Assembled by The Iron Age from Recognized Sources and Are Changed Regularly as More Recent Figures Are Made Available.

	September, 1935	August, 1935	September, 1934	Nine Months, 1934	Nine Months, 1935
Raw Materials:					
Lake ore consumption (gross tons)[a]	2,654,278	2,615,927	1,236,392	18,003,319	21,809,907
Coke production (net tons)[b]	.....	2,833,707	2,228,400	24,572,700	.....
Pig Iron:					
Pig iron output—monthly (gross tons)[c]	1,776,476	1,761,286	898,000	12,976,000	14,857,025
Pig iron output—daily (gross tons)[c]	59,216	56,816	29,935	39,819	56,523
Castings:					
Malleable castings—production (net tons)[d]	.....	35,245	21,541	282,880	.....
Malleable castings—orders (net tons)[d]	.....	35,602	19,511	270,326	.....
Steel castings—production (net tons)[d]	.....	.....	31,816	371,230	.....
Steel castings—orders (net tons)[d]	.....	.....	20,030	360,933	.....
Steel Ingots:					
Steel ingot production—monthly (gross tons)[c]	2,829,835	2,919,326	1,268,977	20,542,334	24,044,076
Steel ingot production—daily (gross tons)[c]	113,193	108,123	50,759	88,165	103,193
Steel ingot production—per cent of capacity[c]	51.13	48.84	23.05	40.04	46.61
Employment in Steel Industry:					
Total employees[c]	.....	423,925	381,828	402,223	.....
Total payrolls (thousands of dollars)[c]	.....	$47,890	$29,143	$356,819	.....
Average hours worked per week[c]	.....	35.0	24.2	28.2	.....
Finished Steel:					
Trackwork shipments (net tons)[c]	2,962	4,028	3,383	42,620	32,619
Sheet steel sales (net tons)[f]	.....	207,140	77,063	1,401,288	.....
Sheet steel production (net tons)[f]	.....	206,613	76,051	1,487,765	.....
Fabricated shape orders (net tons)[g]	.....	86,047	66,586	832,520	.....
Fabricated shape shipments (net tons)[g]	.....	114,906	105,233	792,796	.....
Fabricated plate orders (net tons)[d]	.....	19,305	15,108	182,757	.....
Reinforcing bar awards (net tons)[e]	.....	101,140	7,550	158,280	.....
U. S. Steel Corpn. shipments (tons)[h]	614,933	624,497	370,306	4,797,162	5,341,223
Ohio River steel shipments (net tons)[i]	.....	92,501	45,848	488,125	.....
Fabricated Products:					
Automobile production, U. S. and Canada[k]	.....	247,743	175,586	2,492,695	.....
Construction contracts, 37 Eastern States[l]	.....	$168,557,200	$110,151,200	$1,203,507,200	.....
Steel barrel shipments (number)[d]	.....	600,993	417,114	5,215,953	.....
Steel furniture shipments (dollars)[d]	.....	1,327,252	879,243	8,680,862	.....
Steel boiler orders (sq. ft.)[d]	.....	542,606	539,242	3,367,525	.....
Locomotive orders (number)[m]	7	0	1	89	28
Freight car orders (number)[m]	110	100	4	23,000	7,293
Machine tool index[n]	80.0	125.8	36.2	†37.4	108.5
Foundry equipment index[o]	.....	113.0	46.4	†46.7	.....
Foreign Trade:					
Total iron and steel imports (gross tons)[p]	.....	31,312	23,847	241,579	.....
Imports of pig iron (gross tons)[p]	.....	8,568	12,290	99,091	.....
Imports of all rolled steel (gross tons)[p]	.....	17,657	8,196	85,986	.....
Total iron and steel exports (gross tons)[p]	.....	247,312	301,330	2,030,637	.....
Exports of all rolled steel (gross tons)[p]	.....	82,866	72,165	723,485	.....
Exports of finished steel (gross tons)[p]	.....	64,400	69,302	634,833	.....
Exports of scrap (gross tons)[p]	.....	156,685	225,212	1,275,414	.....
British Production:					
British pig iron production (gross tons)[r]	529,600	543,400	500,300	4,430,300	4,792,300
British steel ingot production (gross tons)[r]	855,900	759,900	734,700	6,627,200	7,220,300
Non-Ferrous Metals:					
Lead production (net tons)[s]	.....	34,856	31,939	304,845	.....
Lead shipments (net tons)[s]	.....	38,195	36,018	277,547	.....
Zinc production (net tons)[t]	36,088	35,922	26,515	261,448	317,052
Zinc shipments (net tons)[t]	42,217	39,200	21,913	260,438	328,741
Deliveries of tin (gross tons)[v]	.....	5,320	3,850	33,915	.....

[c]Preliminary. †Three Months' Average.

Source of figures: [a] Lake Superior Iron Ore Association; [b] Bureau of Mines; [c] THE IRON AGE; [d] Bureau of the Census; [e] American Iron and Steel Institute; [f] National Association of Flat-Rolled Steel Manufacturers; [g] American Institute of Steel Construction; [h] United States Steel Corpn.; [i] United States Engineer, Pittsburgh; [k] When preliminary, from Automobile Manufacturers Association—Final figures from Bureau of the Census; [l] F. W. Dodge Corpn.; [m] *Railway Age;* [n] National Machine Tool Builders Association; [o] Foundry Equipment Manufacturers Association; [p] Department of Commerce; [r] British Iron and Steel Federation; [s] American Bureau of Metal Statistics; [t] American Zinc Institute, Inc.; [v] New York Commodities Exchange.

Steel Production Holds at 52 Per Cent As Automotive Releases Gain

Prospects for Railroad Buying Are Brighter in Mid-West— Large Tonnages Promised for New Public Works Projects

STEEL production has apparently risen as high as it can without the benefit of heavy automobile tonnage. Ingot production this week is unchanged at 52 per cent of capacity, the level from which it has not fluctuated more than half a point in the last six weeks. This period coincides almost exactly with the low point in automobile assemblies occasioned by the fall change to new models.

Under the circumstances the trend of automotive steel releases is being watched more carefully than usual, and the current week offers convincing evidence that the desired support from the motor car makers is commencing. Heavier releases for sheets, bars and strip steel are reported in all districts serving the automobile industry and the week's most significant gains in steel production are reported from Cleveland and the Valleys. Production is unchanged at Pittsburgh, Philadelphia, Buffalo and Wheeling, but a net gain in national output was prevented by a three and one-half point drop to 55½ per cent of capacity at Chicago.

ALTHOUGH Detroit reeks with its usual optimism regarding motor car production, skepticism persists in some quarters. The November change to new models still remains an experiment and the fact that so few important innovations in design have been made has led to the belief that winter selling may not be as easy as it now looks. However, the steel industry stands to benefit in the long run as new models are 50 to 175 lb. heavier. The adoption of steel tops alone adds 30 lb. per car and may add 35,000 tons to the industry's requirements next year.

THE well-sustained requirements of farm implement makers and the steady movement of steel products into miscellaneous consumption are doing much to maintain ingot production. Heavy demand is reported from makers of kitchen utensils, refrigerators, washing machine tubs, stoves and barrels. This has led to higher sheet and strip mill output in some districts, and cold-finished bar makers have stepped up production sharply in response to increased activity in the machine tool and machinery industry.

Railroad buying is still lacking, but prospects are much better in the Middle West where a shortage of freight cars is becoming more pronounced. Some of the carriers have finally admitted that they must either buy rolling stock or undertake large repair programs. In the East, however, the situation is not so encouraging. One important road has 85,000 tons of rails on its right of way and others have relatively large amounts; nor is a shortage of freight cars apparent in that section.

WHILE shipbuilding activity has been largely confined to Navy work, private initiative has appeared with plans for the construction of an ocean liner which will require 15,000 tons of plates. Three car ferries at New York will take 3600 tons and a number of shipyards are busy on repair work and the construction of smaller craft. New Navy projects include two floating drydocks to be built on the Pacific Coast which will take 43,120 tons of steel.

Demand for construction steel continues at a relatively low ebb, although the amount of pending work involving large tonnages continues to grow. Fabricated structural steel awards this week total only 5400 tons, compared with 20,100 tons last week, while new projects call for only 9100 tons, compared with 47,365 tons. The Passamaquoddy power project in Maine will require 20,000 tons of sheet steel piling.

Steel piling makers are also figuring on a number of other public projects but can derive little pleasure from the fact that 1400 tons for an ocean terminal at Morehead City, N. C., is likely to be bought in Germany on a bid 15 per cent under United States quotations. This is in accordance with a PWA ruling of last May.

THE finished steel price structure is generally stronger. Shading is still reported on billets, the price of which was advanced Oct. 1, but plate quotations are more regular and the wide variance in jobber prices on reinforcing bars is being corrected by the distributers.

Establishment of quantity differentials on merchant bars seems to have mollified the larger buyers who brought pressure for lower quotations after the code went into the discard. THE IRON AGE composite price of finished steel is unchanged at 2.130c. a lb.

Scrap prices are steady in line with steel ingot operations. Purchase of 30,000 tons by a Chicago district consumer reaffirmed the prevailing level there, but few tests of the market have been offered in other important districts. THE IRON AGE composite scrap price is unchanged at $12.67 a ton. Pig iron buying continues active with prices strong. The composite price is holding at $17.84 a ton.

A Comparison of Prices

Market Prices at Date, and One Week, One Month, and One Year Previous; Advances Over Past Week in Heavy Type, Declines in Italics

Pig Iron

Per Gross Ton:	Oct. 15, 1935	Oct. 8, 1935	Sept. 17, 1935	Oct. 16, 1934
No. 2 fdy., Philadelphia	$20.3132	$20.3132	$20.3132	$20.26
No. 2, Valley furnace	18.50	18.50	18.50	18.50
No. 2 Southern, Cin'ti	19.2007	19.2007	19.2007	19.13
No. 2, Birmingham†	14.50	14.50	14.50	14.50
No. 2 foundry, Chicago*	18.50	18.50	18.50	18.50
Basic, del'd eastern Pa.	19.8132	19.8132	19.8132	19.76
Basic, Valley furnace	18.00	18.00	18.00	18.00
Malleable, Chicago*	18.50	18.50	18.50	18.50
Malleable, Valley	18.50	18.50	18.50	18.50
L. S. charcoal, Chicago	24.7528	24.7528	24.2528	24.04
Ferromanganese, seab'd carlots	85.00	85.00	85.00	85.00

†This quotation is for delivery in South; in the North prices are 38c. a ton under delivered quotations from nearest Northern furnace.

*The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Rails, Billets, etc.

Per Gross Ton:				
Rails, heavy, at mill	$36.37½	$36.37½	$36.37½	$36.37½
Light rails, Pittsburgh	35.00	35.00	35.00	35.00
Rerolling billets, Pittsburgh	27.00	27.00	27.00	27.00
Sheet bars, Pittsburgh	28.00	28.00	28.00	28.00
Slabs, Pittsburgh	27.00	27.00	27.00	27.00
Forging billets, Pittsburgh	35.00	35.00	35.00	32.00
Wire rods, Pittsburgh	38.00	38.00	38.00	38.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	1.70	1.70	1.70	1.70

Finished Steel

Per Lb.:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	1.85	1.85	1.80	1.80
Bars, Chicago	1.90	1.90	1.85	1.85
Bars, Cleveland	1.90	1.90	1.85	1.85
Bars, New York	2.20	2.20	2.15	2.13
Plates, Pittsburgh	1.80	1.80	1.80	1.80
Plates, Chicago	1.85	1.85	1.85	1.85
Plates, New York	2.09	2.09	2.09	2.08
Structural shapes, Pittsburgh	1.80	1.80	1.80	1.80
Structural shapes, Chicago	1.85	1.85	1.85	1.85
Structural shapes, New York	2.06¼	2.06¼	2.06¼	2.05¼
Cold-finished bars, Pittsburgh	1.95	1.95	1.95	2.10
Hot-rolled strips, Pittsburgh	1.85	1.85	1.85	1.85
Cold-rolled strips, Pittsburgh	2.60	2.60	2.60	2.60

Finished Steel

Per Lb.:	Oct. 15, 1935 Cents	Oct. 8, 1935 Cents	Sept. 17, 1935 Cents	Oct. 16, 1934 Cents
Hot-rolled annealed sheets, No. 24, Pittsburgh	2.40	2.40	2.40	2.40
Hot-rolled annealed sheets, No. 24, Gary	2.50	2.50	2.50	2.50
Sheets, galv., No. 24, P'gh	3.10	3.10	3.10	3.10
Sheets, galv., No. 24, Gary	3.20	3.20	3.20	3.20
Hot-rolled sheets, No. 10, P'gh	1.85	1.85	1.85	1.85
Hot-rolled sheets, No. 10, Gary	1.95	1.95	1.95	1.95
Wire nails, Pittsburgh	2.40	2.40	2.40	2.60
Wire nails, Chicago dist. mill	2.45	2.45	2.45	2.65
Plain wire, Pittsburgh	2.30	2.30	2.30	2.30
Plain wire, Chicago dist. mill	2.35	2.35	2.35	2.35
Barbed wire, galv., Pittsburgh	2.80	2.80	2.80	3.00
Barbed wire, galv., Chicago dist. mill	2.85	2.85	2.85	3.05
Tin plate, 100 lb. box, P'gh.	$5.25	$5.25	$5.25	$5.25

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	$13.50	$13.50	$13.25	$10.25
Heavy melting steel, Phila.	12.00	12.00	12.50	9.50
Heavy melting steel, Ch'go	12.50	12.50	12.50	8.75
Carwheels, Chicago	12.75	12.75	12.75	9.50
Carwheels, Philadelphia	12.75	12.75	11.75	11.25
No 1 cast, Pittsburgh	14.25	14.25	14.25	11.25
No. 1 cast, Philadelphia	11.75	11.75	11.75	11.75
No. 1 cast, Ch'go (net ton)	11.25	1.25	11.25	8.00
No. 1 RR. wrot., Phila.	12.25	12.25	12.25	11.25
No. 1 RR. wrot., Ch'go (net)	9.50	9.50	9.50	7.00

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$3.60	$3.60	$3.25	$3.85
Foundry coke, prompt	4.25	4.25	4.00	4.60

Metals

Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Electrolytic copper, refinery	9.00	9.00	8.75	8.75
Lake copper, New York	9.37½	9.37½	9.12½	9.12½
Tin (Straits), New York	53.00	51.00	49.50	50.95
Zinc, East St. Louis	4.85	4.85	4.60	3.80
Zinc, New York	5.22½	5.22½	4.97½	4.15
Lead, St. Louis	4.35	4.45	4.20	3.45
Lead, New York	4.50	4.60	4.35	3.60
Antimony (Asiatic), N. Y.	15.75	14.40	13.50	9.50

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

The Iron Age Composite Prices

	Finished Steel	Pig Iron	Steel Scrap
Oct. 15, 1935	2.130c. a Lb.	$17.84 a Gross Ton	$12.67 a Gross Ton
One week ago	2.130c.	17.84	12.67
One month ago	2.124c.	17.84	12.75
One year ago	2.124c.	17.90	9.50
	Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strips. These products make 85 per cent of the United States output.	Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.	Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	Finished Steel High	Finished Steel Low	Pig Iron High	Pig Iron Low	Steel Scrap High	Steel Scrap Low
1935	2.130c., Oct. 1	2.124c., Jan. 8	$17.90, Jan. 8	$17.83, May 14	$12.83, Oct. 1	$10.33, April 23
1934	2.199c., April 24	2.008c. Jan. 2	17.90, May 1	16.90, Jan. 27	13.00, Mar. 13	9.50, Sept. 25
1933	2.015c., Oct. 3	1.867c., April 18	16.90, Dec. 5	13.56, Jan. 3	12.25, Aug. 8	6.75, Jan. 3
1932	1.977c., Oct. 4	1.926c., Feb. 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.43, July 5
1931	2.037c., Jan. 13	1.945c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.273c., Jan. 7	2.018c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.317c., April 2	2.273c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.286c., Dec. 11	2.217c., July 17	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	13.08, July 2
1927	2.402c., Jan. 4	2.212c., Nov. 1	19.71, Jan. 4	17.54, Nov. 1	15.25, Jan. 11	13.08, Nov. 22

Output Rises Three Points In Valley Producing Area

Pittsburgh and Wheeling District Operations Unchanged Although Finishing Mill Schedules Are Tending Higher

PITTSBURGH, Oct. 15. — Steel activity in the Pittsburgh area continues to follow an extremely steady trend with ingot output this week unchanged at 45 per cent of capacity. An increase in miscellaneous and automobile steel orders has provided a three-point lift in output to 56 per cent in the Valleys and nearby northern Ohio mills. The Wheeling district is emulating the steadiness of the Pittsburgh producing area, and, for the sixth consecutive week, operations are holding at 80 per cent.

A glance at steel order books in most instances would show little, if any, change in the character of consumer demand. Except for strip steel and hot-rolled bars, automotive demand reaching the Pittsburgh district has not increased, while the volume of miscellaneous business is rather generally unchanged.

Indicative of the steadiness of finished steel demand is the even pace of finishing mill schedules. In the current week, sheet mill output is unchanged at 70 per cent, and strip steel and tin plate both at about 50 per cent. Production has expanded at some hot rolled bar mills, while cold-finished bar output has risen sharply to around 60 per cent. Pipe and wire mills are maintaining recent schedules.

Steel producers here still are sanguine that demand from the automotive industry will expand measurably within the next fortnight. Buying by the railroads gives little promise of swelling order books for the remainder of the quarter, while construction steel requirements still seem to be depending largely upon public fund expenditures.

Pig Iron

Although foundry melt at mill equipment shops and radiator plants is fairly heavy, little tonnage from these sources is reaching the open market. The former group still is adhering generally to reciprocal arrangements, while the latter are using largely high phosphorus iron from Southern sources. Railroad equipment and brake shoe manufacturers are not adding a great deal to furnace order books. Quotations are well maintained.

Semi-Finished Steel

Some consumers now are working off stocks of semi-finished contracted for prior to upward revisions in extras. Notable in this group are users of forging quality billets, the base price of which was advanced $2 last month.

Bolts, Nuts and Rivets

Automotive demand is increasing, while interest from miscellaneous sources is merely holding its own. Aggregate tonnage for October is showing up better than that in the fore part of September. A semblance of stability in prices is evident, but until jobbers who bought bolts and nuts last month at cheap prices work off such low-priced stocks, the entire market cannot be regarded as strong.

Rails and Track Accessories

Inquiries are few. The closing of bids on Oct. 16 on about 10,000 tons for Norfolk & Western portends early placement of a substantial share of the order in this district.

Reinforcing Steel

The flow of public money leading to reinforcing steel projects is rather thin, and such public lettings as are reported have not driven in much tonnage. Contract lettings for road work notably are an example and will not materially increase the movement of steel until next spring. The bulk of current shipments represent releases against orders for old jobs. New private work is appearing slowly and is beginning to reflect seasonal trends. Prices appear to be more uniformly steady, but weakness in distributor's quotations still persists.

Cold-Finished Bars

Specifications against September bookings and new orders are relatively heavy. Consequently some producers' backlogs will be maintained fairly well throughout the month. In one instance, October promises to be the largest shipping month since 1929. Contributing to the vigorous tone of this market is improved demand from automotive industry, machine tool equipment trade, makers of office appliances, bicycles and conveying machinery. Operations in the cold finished industry now are averaging around 60 per cent, an advance of more than 30 points since mid-September.

Tubular Products

Demand for boiler tubes and mechanical tubing has improved slightly. The movement of oil-country goods is extremely steady, while shipments of standard pipe are in sustained volume owing largely to improved activity in the home building field. Pipe mills in this district are maintaining schedules at around 40 to 45 per cent of capacity.

Bars

Some automobile parts makers have entered the market in a fairly large way. This tonnage has forced some bar mills to accelerate rolling schedules. The new base of 1.85c., Pittsburgh, is meeting with little resistance, but large-tonnage orders earning the deductions under the new hot rolled bar set-up are still limited in number.

Wire Products

Releases against tonnage booked in September are providing most mills with relatively heavy producing schedules. A small improvement is noticeable in demand for manufacturers' wire for automotive consumption. Jobbers are not unusually active, having covered quite substantially prior to the new wire price schedule effective on Oct. 1. Wide resistance to the new methods of quoting has not yet developed. Mill base quotations are fairly well established.

Plates and Shapes

Plate inquiries in this district are quite limited, with new barge construction being figured largely on single bottoms. Featuring the list of new structural steel inquiries reported for the past week is 1500 tons for plaza sections for Port of New York Authority at Weehawken, N. J. Alterations to Emsworth lock and dam, Neville Island, Pa., will require 460 tons.

Sheet Steel Piling

Domestic producers report that the Port Commission handling the Morehead City, N. C., ocean ter-

minal project, intends to award 1400 tons to T. A. Loving, Goldsboro, N. C., low bidder, based on furnishing German piling sections. Bids were taken on PWA docket 642 on Oct. 1. The Commission may purchase German piling in accordance with clause stipulated by the PWA authorities, approving the purchase of foreign materials bid at a cost of 15 percent or less under domestic goods. Preliminary estimates of piling requirements for the Passamaquoddy power development project, Bay of Fundy, Me., are given at 20,000 tons. Bids soon are expected to be requested by the United States Engineer Office at Eastport, Me.

Sheets

Bookings in the past week, while not so heavy as those in the preceding period, were in sufficient volume to sustain sheet mill output at around 70 per cent of capacity. New orders received in the past week were notably lacking in substantial automobile tonnage. Prominent on order lists were barrel and electrical equipment manufacturers. Low-priced galvanized roofing, purchased prior to the elimination of jobbing allowances on Oct. 1, are disturbing secondary markets, but mill prices appear to be generally maintained.

Tin Plate

Mill schedules are fluctuating narrowly, with shipping releases dribbling in for miscellaneous needs. Stocks of tin plate, including that rolled against orders and mill inventories, still are abnormally heavy, and it is dubious that these stocks will be pared down materially before the end of the year. A modicum of relief may be provided by the small spreading of orders for "beer plate." In the current week production will hold at 50 per cent of capacity.

Strip Steel

Further improvement in demand from the automotive industry is reported by producers in this district. Releases, however, are increasing only gradually, and operations in the current week probably will not exceed last week's rate of around 50 per cent. Bookings for automobile items also are quickening gradually, and expectations of a steady increase for the remainder of October are strong.

Coal and Coke

Demand for domestic lump coal still is active, despite a spell of mild weather. Inquiry for industrial grades is increasing, but producers do not expect substantially heavier movement in these grades until stock accumulations have been worked off to normal inventory levels by the end of this year. Screening for domestic sizes has built up unwieldy stocks of slack, which usually is plentiful at this season. Slack prices, as a consequence, are not sharing the general firmness of quotations for other grades. Domestic stove and egg coke, which is quotable at $3.75, Connellsville ovens, will be advanced 20c. a ton on Oct. 21 to $3.95, ovens.

Scrap

Mill interest in scrap remains narrow and recent transactions have been largely restricted to dealer buying against orders. Regardless of apathetic consumer demand, prices are quite steady. An indication of the firm position of quotations is the lack of offerings from small dealers who evidently are not inclined to press sales. On a recent sale, blast furnace scrap has advanced 50c. a ton to $8.50 to $9, delivered.

Weekly Earnings Show Improvement

AVERAGE weekly earnings of wage-earners in 10 major industries in July, 1935, showed a substantial recovery from their depression lows. Earnings in general are, however, still well below their 1929 levels. The shorter work week is responsible for this. These are the results of a study of the course of earnings in the last six years just prepared by the National Industrial Conference Board.

Except for bituminous coal mining, manufacturing industry showed the greatest decline in average weekly earnings during the depression, the index falling from 100 in 1929 to 60.6 in 1933. This industry, however, has recovered 30.2 per cent of the total decline, and in July, 1935, the index stood at 78.9. Hours of work per week in manufacturing industry fell during 1933 and reached the low in September, 1934, when they were 33.3. In July, 1935, they had only recovered 5.7 per cent of the decline and the average work week was 35.2 hr.

Weekly earnings in the bituminous coal mining industry in July, 1935, showed a rise of 22.4 per cent, and in Class I railroads they rose 20.7 per cent from the low point of the depression. The index of the former, however, had declined to 41.6 and the latter to only 76.0 of the 1929 level. Hours of work in bituminous coal mining reached the lowest point in the depression in July, 1935, when labor conditions were particularly unsettled. Hours of work in Class I railroads had recovered 7.5 per cent from the low point, 40.1, reached in April, 1933, by July, 1935, when they stood at 43.1.

Weekly Indications of Steel Activity

From THE IRON AGE

	Oct. 15, 1935	Oct. 8, 1935	Sept. 17, 1935	Oct. 16, 1934	Average Year to Date 1935	1934
Steel ingot operations—Per cent of capacity	52.0	52.0	52.0	23.5	46.7	38.9

	Week Ended Oct. 15, 1935	Oct. 8, 1935	Sept. 17, 1935	Oct. 16, 1934	Year to Date 1935	1934
Fabricated structural steel awards	5,400	20,100	14,750	8,580	565,830	630,730
Fabricated plate awards	1,650	500	2,695	2,200	114,137	103,342
Sheet steel piling awards	0	3,300	0	1,600	51,290	47,350
Reinforcing bar awards	3,415	6,750	5,810	1,360	258,915	164,906

Production Falls at Chicago Despite Heavy Steel Orders

Railroad Car Shortage in Northwest Promises Rolling Stock Purchases by Carriers—Scrap Unchanged On Large Sale

CHICAGO, Oct. 15.—Production has fallen 3½ points to 55½ per cent of capacity in the face of specifications that are the third best of the year.

This condition, however, is accounted for by the character of specifications which are largely for those classifications of steel which are seldom stocked, even in the raw condition, and which require more time in the process than do the ordinary grades. Further, it is a reflection of the growing demand from automobile centers from which specifications are largely for the special steels.

The automobile situation is not clear to many business men in the Middle West who are beginning to doubt just how effective the fall new model idea will be from the standpoint of sales to ultimate consumers.

A trade wind is again blowing from the railroads which after many weeks of struggle with the matter of supplying certain types of cars are finally willing to admit that the emergency actually exists. The step most pleasing to steel producers would be an active attempt to meet this car shortage through the purchase of new equipment. There are those who believe that this move is not far in the future.

A heavy purchase of steel mill scrap at current price levels gives indication that the door is closed to higher prices for the time being. In fact, some consumers are beginning to offer tonnages at lower levels but there have been no takers.

Pig Iron

Shipments in the first nine months of this year have topped the corresponding period of 1934 by 35 per cent. The upward trend that started late in July is continuing into October, which will, in all probability exceed September by not less than 25 per cent. Prices are unusually strong and many consumers who have placed fourth quarter contracts are adding to their purchases in anticipation of higher prices. Furnace stocks continue to shrink at practically all centers.

Reinforcing Bars

While dealers are still fortified with fair order books, they are looking anxiously for additional tonnage. The actual inquiry list has been slowly shrinking notwithstanding that projected work probably stands as high as at any time this year. The stumbling block is the dependence of this market on Government spending, which, for one reason or another, is kept from getting under way except on a limited scale. The Illinois crossing program is still believed to be some distance in the future. A housing project in Milwaukee is active, but like those in Chicago, seems to be put away in moth balls.

Cast Iron Pipe

Business in the immediate Chicago territory remains dull and the next few weeks do not hold much promise. Even carload orders are scarce. A large tonnage will soon develop at Cincinnati where a filter plant is being designed. Denver, Colo., is also on the list with a filter plant, bids on which will probably be taken in November. Industrial use of cast iron pipe is practically non-existent and utilities find need for very small and infrequent lots.

Rails

This market is quiet except for the fact that a number of railroads are now beginning actively to compute their future requirements. Mills are holding operations at a steady level and anticipate that additional tonnages will be at hand before mid-November so there will be no major interruption of schedules. The Santa Fe, which announced several weeks ago a major program for roadbed work, has given out no further details.

Plates

Mills continue their active hunt for plate tonnage which is scarce and very difficult to find. Some hope lies in the direction of the railroads which, now, after several weeks of denial, are willing to admit that they are experiencing shortages of several types of freight cars. However, there are as yet no announcements of the first steps necessary to be taken at the start of car building programs. Another potential source of tonnage is along the Mississippi River, across which there are still a number of dams to be built. It is understood that plans for these dams are well under way and that possibly some bids will be taken before the end of the year.

Sheets

Chicago district hot mills are well engaged and specifications point to steady, if not a higher, rate of operations in the near future. Miscellaneous demand is in good volume and automobile centers are taking larger quantities though not of the size that mills had expected by mid-October. Prices remain firm.

Bars

Releases by automobile plants and parts makers are heavier but how far they will go is still a question that cannot be answered. In fact, many are beginning to think that the fall model idea may not live up to expectations. The farm implement group has attained output of 75 per cent of base which is the average of the output of the years 1928 to 1930 inclusive. Tractor plants remain at capacity and harvesting and haying machinery have contributed much to the welfare of this industry.

Wire

Output has climbed to 65 per cent of capacity and still more wire products are being taken from mill stocks than are being added. The jobber tonnage is heavier but it still represents only nearby requirements. Some automobile business has been closed and the trade looks for other substantial tonnages in a week to 10 days. In general, the manufacturing business is growing. Although the utility load continues to grow there is little demand for electrical cable beyond the needs for maintenance. Some business should develop as a result of the move throughout the country for the removal of overhead transmission lines near airports, the plan being to place these lines underground.

Structural Material

Awards are unusually light and fresh inquiries are in small volume. However, as fabricators turn their eyes to the project list, they can see fair operations over the next few months. It is now reported that figures will be taken within 30 to 60 days on the Illinois over-

head crossing tonnages. It is also reported that additional dam work will be undertaken along the Mississippi River before the end of the year.

Scrap

A local mill has purchased 30,000 tons of heavy melting steel at $12.75, delivered. Another mill has made an offer at $1.50 a ton under the market but can find no takers. The market cannot be said to be strong, there being too much good scrap coming on track for that, but it gives the impression of having staying qualities, if only for the immediate future. Boat shipments are coming into Chicago from the Northwest, and cargoes of borings and busheling are leaving local docks for Lake Erie ports. It is entirely conceivable that a real test of the price structure can come before the end of the month.

Fabricated Structural Steel

Lettings Light—New Projects in Small Volume

BOOKINGS of fabricated structural steel, at 5400 tons, are the smallest since the first week in August and compare with 20,100 tons last week. The only sizable award is 1400 tons for the second section of the Chevrolet Motor Co. plant at Indianapolis. New projects of 9100 tons compare with 47,365 tons in the previous week and 16,200 tons two weeks ago. Fresh inquiries include 1500 tons for plaza sections at Weehawken, N. J., for the Port of New York Authority, and 1400 tons for an armory at West Point, N. Y. Other new jobs are mostly in small tonnages. Plate awards call for 1650 tons. New sheet piling projects include an estimated tonnage of 20,000 tons for the Passamaquoddy power development project in Maine. Structural steel awards for the week follow:

NORTH ATLANTIC STATES

Dartmouth, Mass., 100 tons, highway bridge, to Boston Bridge Works, Inc.

Boston, 105 tons, Central Congregational Church, to A. O. Wilson Structural Steel Co.

Lynn, Mass., 220 tons, addition to boiler plant for Lynn Gas & Electric Co., to New England Structural Co.

New York, 135 tons, Church of the Good Shepherd, to Post & McCord.

Brooklyn, 110 tons, building for Borden Dairy Co., to Harris Structural Steel Co.

Brooklyn, 410 tons, Navy Yard building extension, to Harris Structural Steel Co.

Hoboken, N. J., 360 tons, building for R. H. Davis Co., to Ingalls Iron Works Co.

THE SOUTH

Miami, Fla., 450 tons, waterfront improvements, to Virginia Bridge & Iron Co.

Sheffield, Ala., 335 tons, transmission towers for TVA, to American Bridge Co.

Pecos, Tex., 250 tons, crest gates for Red Bluff dam, to Virginia Bridge & Iron Co.

CENTRAL STATES

Pontiac, Mich., 300 tons, storage building for Pontiac Motor Car Co., to Whitehead & Kales, Inc.

Cleveland, 100 tons, building for Triplex Screw Co., to Republic Structural Iron Works.

Cleveland, 112 tons, Hollenden Hotel garage, to Republic Structural Iron Works.

Indianapolis, 1400 tons, second section of Chevrolet plant, to R. C. Mahon Co.

Dane County, Wis., 165 tons, bridge, to Vierling Steel Works.

Washington County, Iowa, 170 tons, State highway bridge, to McClintic Marshall Corpn.

East St. Louis, Ill., 130 tons, Radiant Fuel Co. building, to St. Louis Structural Steel Co.

WESTERN STATES

Boulder City, Nev., 150 tons, walkway supports, to Reliance Steel Products Co.

Parco, Wyo., 100 tons, warehouse at Seminoe dam, to an unnamed bidder.

Los Angeles, 250 tons, tunnel ribs for Metropolitan Water District, Specification No. 131, to Consolidated Steel Corpn.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

Boston, 100 tons, church in Jamaica Plain.

West Point, 1400 tons, armory.

Wassaic, N. Y., 150 tons, New York State school.

Wassaic, N. Y., 100 tons, school; bids Oct. 23.

Schenectady, N. Y., 600 tons, state armory; bids Oct. 25.

Salem, N. J., 240 tons, building for Austin Co.

Weehawken, N. J., 1500 tons, plaza sections for Port of New York Authority.

Neville Island, Pa., 460 tons, alterations to Emsworth lock and dam.

Wyoming County, Pa., 200 tons, truss bridge; bids Oct. 18.

SOUTH AND SOUTHWEST

Sheffield, Ala., 1275 tons, bridge.

Konawa, Okla., 823 tons, highway bridge; Kelliher Construction Co., general contractor.

Texas County, Okla., 130 tons, highway bridge; R. W. Tway, general contractor, Oklahoma City.

CENTRAL STATES

State of Indiana, 575 tons, five bridges.

State of Indiana, 1200 tons, highway bridges.

St. Louis, 125 tons, Southwest high school; Boaz-Kiel Construction Co., St. Louis, general contractor.

Columbia, Mo., 200 tons, engineering and library building for University of Missouri.

State of Nebraska, 650 tons, highway bridges.

WESTERN STATES

Wiggins, Colo., 300 tons, State bridge over Bijou Creek; bids Oct. 21.

Colorado Springs, Colo., 360 tons, city bridges.

Ahsahka, Idaho, 300 tons, bridge.

Salt Lake County, Utah, 100 tons, State underpass; bids Oct. 21.

Mare Island, Cal., 135 tons, special tees for Navy Yard; bids opened.

Los Angeles, 100 tons, 6-in. arch ribs for Metropolitan Water District, Specification No. 45618; Consolidated Steel Corpn. low bidder.

Torrance, Cal., 125 tons, pumping plant for water system; bids Oct. 29.

Bonneville Dam, Ore., 390 tons, power house superstructure; General Construction Co. and J. F. Shea Co. low bidders on general contract.

FABRICATED PLATES

AWARDS

Dunkirk, N. Y., 300 tons, standpipe, to McClintic-Marshall Corpn.

Washington, 130 tons, steel pipe, for Capitol power plant, to Alco Products Co.

Everett, Wash., 1000 tons, 24 and 36-in. pipe line, to Puget Sound Machinery Depot.

Arcadia, Cal., 120 tons, 16-in. welded pipe, to an unnamed bidder.

NEW PROJECTS

Defiance, Ariz., 2500 to 3200 tons, tanks for Hopi Valley irrigation district; bids opened.

Denver, 900 tons, five steel siphons on South Boulder diversion conduit; Thompson Mfg. Co. low bidder.

SHEET PILING

NEW PROJECTS

Bay of Fundy, Me., 20,000 tons, estimated, Passamaquoddy power development project; United States Engineer Office, Eastport, Me.

Morehead City, N. C., 1400 tons, ocean terminal; T. A. Loving, Goldsboro, N. C., low bidder based on furnishing German piling sections.

Peoria, Ill., 1200 tons, for Illinois River lock; bids Oct. 22.

Battelle Institute Increases Personnel

BATTELLE Memorial Institute, Columbus, Ohio, has increased its technical staff to care for an expanding program of industrial research. New appointments to the division of physical metallurgy include: M. L. Samuels, formerly metallurgist at the Tennessee Coal, Iron & Railroad Co.; J. G. Lowther, formerly research fellow at the University of Illinois; and Robert E. Parkinson, heretofore with the Inland Steel Co. Lloyd R. Jackson, formerly assistant research supervisor for the Jones & Laughlin Steel Corpn., has been assigned to the division of general metallurgy.

Prices of Finished Steel and Iron Products

BARS, PLATES, SHAPES

Iron and Steel Bars

Soft Steel — *Base per Lb.*

F.o.b. Pittsburgh	1.85c.
F.o.b. Chicago	1.90c.
F.o.b. Gary	1.90c.
F.o.b. Duluth	2.00c.
Del'd Detroit	2.00c.
F.o.b. Cleveland	1.90c.
F.o.b. Buffalo	1.95c.
Del'd Philadelphia	2.16c.
Del'd New York	2.20c.
F.o.b. Birmingham	2.00c.
F.o.b. cars dock Gulf ports	2.25c.
F.o.b. cars Pacific ports	2.40c.

Rail Steel

(For merchant trade)

F.o.b. Pittsburgh	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Gary	1.75c.
F.o.b. Moline, Ill.	1.75c.
F.o.b. Cleveland	1.75c.
F.o.b. Buffalo	1.80c.
F.o.b. Birmingham	1.85c.
F.o.b. cars dock Gulf ports	2.10c.
F.o.b. cars dock Pacific ports	2.25.

Billet Steel Reinforcing

(Straight lengths as quoted by distributors)

F.o.b. Pittsburgh	2.05c.
F.o.b. Chicago	2.10c.
F.o.b. Gary	2.10c.
Del'd Detroit	2.20c.
F.o.b. Cleveland	2.10c.
F.o.b. Youngstown	2.10c.
F.o.b. Buffalo	2.10c.
F.o.b. Birmingham	2.10c.
F.o.b. cars dock Gulf ports	2.45c.
F.o.b. cars dock Pacific ports	2.45c.

Rail Steel Reinforcing

(Straight lengths as quoted by distributors)

F.o.b. Pittsburgh	1.90c.
F.o.b. Chicago	1.95c.
F.o.b. Gary	1.95c.
F.o.b. Cleveland	1.95c.
F.o.b. Youngstown	1.95c.
F.o.b. Buffalo	1.95c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.30c.
F.o.b. cars dock Pacific ports	2.30c.

Iron

F.o.b. Chicago	1.80c.
F.o.b. Terre Haute, Ind.	1.75c.
F.o.b. Louisville, Ky.	2.10c.
F.o.b. Danville, Pa.	1.80c.
F.o.b. Berwick, Pa.	1.70c.

Cold Finished Bars and Shafting*

Base per Lb.

F.o.b. Pittsburgh	1.95c.
F.o.b. Chicago	2.00c.
F.o.b. Gary	2.00c.
F.o.b. Cleveland	2.00c.
F.o.b. Buffalo	2.05c.
Del'd Detroit	2.15c.
Del'd eastern Michigan	2.20c.

* In quantities of 10,000 to 19,000 lb.

Fence and Sign Posts

Angle Line Posts

Base per Net Ton

F.o.b. Pittsburgh	$50.00
F.o.b. Chicago	50.00
F.o.b. Duluth	51.00
F.o.b. Cleveland	50.00
F.o.b. Birmingham	53.00
F.o.b. Houston, Orange, Beaumont, Galveston	59.00
F.o.b. Mobile	58.00
F.o.b. New Orleans, Lake Charles, Corpus Christi	59.00
F.o.b. cars dock Pacific ports	63.00

Plates

Base per Lb.

F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
F.o.b. Gary	1.85c.
Del'd Cleveland	1.995c.
F.o.b. Coatesville	1.90c.
F.o.b. Sparrows Point	1.90c.
Del'd Philadelphia	1.99c.
Del'd New York	2.09c.
F.o.b. Birmingham	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.
Wrought iron plates, f.o.b. P'gh	3.20c.

Floor Plates

F.o.b. Pittsburgh	3.35c.
F.o.b. Chicago	3.40c.
F.o.b. Coatesville	3.45c.
F.o.b. cars dock Gulf ports	3.75c.
F.o.b. cars dock Pacific ports	3.90c.

Structural Shapes

Base per Lb.

F.o.b. Pittsburgh	1.80c.
F.o.b. Chicago	1.85c.
Del'd Cleveland	1.995c.
F.o.b. Buffalo	1.90c.
F.o.b. Bethlehem	1.90c.
Del'd Philadelphia	2.015c.
Del'd New York	2.0625c.
F.o.b. Birmingham (standard)	1.95c.
F.o.b. cars dock Gulf ports	2.20c.
F.o.b. cars dock Pacific ports	2.35c.

Steel Sheet Piling

Base per Lb.

F.o.b. Pittsburgh	2.15c.
F.o.b. Chicago	2.25c.
F.o.b. Buffalo	2.25c.
F.o.b. cars dock Gulf ports	2.60c.
F.o.b. cars dock Pacific ports	2.60c.

SHEETS, STRIP, TIN PLATE TERNE PLATE

Sheets

Hot Rolled

Base per Lb.

No. 10, f.o.b. Pittsburgh	1.85c.
No. 10, f.o.b. Gary	1.95c.
No. 10, del'd Detroit	2.05c.
No. 10, del'd Phila.	2.16c.
No. 10, f.o.b. Birmingham	2.00c.
No. 10, f.o.b. cars dock Pacific ports	2.40c.

Hot-Rolled Annealed

No. 24, f.o.b. Pittsburgh	2.40c.
No. 24, f.o.b. Gary	2.50c.
No. 24, del'd Detroit	2.60c.
No. 24, del'd Phila.	2.71c.
No. 24, f.o.b. Birmingham	2.55c.
No. 24, f.o.b. cars dock Pacific ports	3.05c.
No. 24, wrought iron, Pittsburgh	4.30c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	2.50c.
No. 10 gage, f.o.b. Gary	2.60c.
No. 10 gage, del'd Detroit	2.70c.
No. 10, gage, del'd Phila.	2.81c.
No. 10 gage, f.o.b. Birmingham	2.65c.
No. 10 gage, f.o.b. cars dock Pacific ports	3.10c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	2.95c.
No. 20 gage, f.o.b. Gary	3.05c.
No. 20 gage, del'd Detroit	3.15c.
No. 20 gage, del'd Phila	3.26c.
No. 20 gage, f.o.b. Birmingham	3.10c.
No. 20 f.o.b. cars dock Pacific ports	3.50c.

Galvanized Sheets

No. 24 gage, f.o.b. Pittsburgh	3.10c.
No. 24, f.o.b. Gary	3.20c.
No. 24, del'd Phila.	3.41c.
No. 24, f.o.b. Birmingham	3.25c.
No. 24, f.o.b. cars dock Pacific ports	3.70c.
No. 24, wrought iron, Pittsburgh	4.95c.

Long Ternes

No. 24, unassorted 8-lb. coating f.o.b. Pittsburgh	3.40c.
F.o.b. Gary	3.50c.
F.o.b. cars dock Pacific ports	4.10c.

Vitreous Enameling Stock

No. 20, f.o.b. Pittsburgh	3.10c.
No. 20, f.o.b. Gary	3.20c.
No. 20, f.o.b. Birmingham	3.70c.
No. 20, f.o.b. cars dock Pacific ports	3.70c.
No. 10, f.o.b. Pittsburgh	2.50c.
No. 10, f.o.b. Gary	2.60c.
No. 10, f.o.b. Birmingham	3.10c.
No. 10, f.o.b. cars dock Pacific ports	3.10c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh	2.75c.
No. 28, Gary	2.85c.
No. 28, cars dock Pacific Coast ports	3.35c.

Tin Plate

Per Base Box

Standard cokes, f.o.b. P'gh district mill	$5.25
Standard cokes, f.o.b. Gary	5.35
Standard cokes, f.o.b. cars dock Pacific ports	5.90

Terne Plate

(F.o.b. Pittsburgh)

(Per Package, 20 x 28 in.)

8-lb. coating I.C.	$10.00
15-lb. coating I.C.	12.00
20-lb. coating I.C.	13.00
25-lb. coating I.C.	14.00
30-lb. coating I.C.	15.25
40-lb. coating I.C.	17.50

Hot-Rolled Hoops, Bands, Strips and Flats under ¼ in.

Base per Lb.

All widths up to 24 in., P'gh	1.85c.
All widths up to 24 in., Chicago	1.95c.
All widths up to 24 in., del'd Detroit	2.05c.
All widths up to 24 in., Birmingham	2.00c.
Cooperage stock, Pittsburgh	1.95c.
Cooperage stock, Chicago	2.05c.

Cold-Rolled Strips

Base per Lb.

F.o.b. Pittsburgh	2.60c.
F.o.b. Cleveland	2.60c.
Del'd Chicago	2.895c.
F.o.b. Worcester	2.80c.

Fender Stock

No. 14, Pittsburgh or Cleveland	2.90c.
No. 14, Worcester	3.30c.
No. 20, Pittsburgh or Cleveland	3.30c.
No. 20, Worcester	3.70c.

Hot-Rolled Rail Steel Strips

Base per Lb.

F.o.b. Pittsburgh	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Birmingham	1.85c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

To Manufacturing Trade — *Per Lb.*

Bright wire	2.30c.
Spring wire	2.90c.

Chicago prices on products sold to the manufacturing trade are $1 a ton above Pittsburgh or Cleveland. Worcester and Duluth prices are $2 a ton above, Birmingham $3 above, and Pacific Coast prices $9 a ton above Pittsburgh or Cleveland.

To Larger Lot Buyers

Base per keg

Standard wire nails	$2.40
Smooth coated nails	2.40

Base per 100 Lb.

Annealed fence wire	$2.45
Galvanized fence wire	2.80
Polished staples	3.10
Galvanized staples	3.35
Barbed Wire, galvanized	2.80
Twisted barbless wire	2.80
Woven wire fence, base column	58.00
Single loop bale ties, base column	53.00

Chicago and Anderson, Ind., mill prices are $1 a ton over Pittsburgh base (on all products except woven wire fence, for which the Chicago price is $2 above Pittsburgh); Duluth, Minn., and Worcester, Mass., mill prices are $2 a ton over Pittsburgh (except for woven wire fence at Duluth, which is $3 over Pittsburgh), and Birmingham mill prices are $3 a ton over Pittsburgh.

On wire nails, barbed wire, staples and fence wire, prices at Houston, Galveston and Corpus Christi, Tex., New Orleans, Lake Charles, La., and Mobile, Ala., are $6 a ton over Pittsburgh, while Pacific Coast prices are $8 over Pittsburgh. Exception: on fence wire Pacific Coast prices are $11 a ton above Pittsburgh.

On staples and barbed wire, prices of $6 a ton above Pittsburgh are also quoted at Beaumont and Orange, Tex.

Wire Hoops, Twisted or Welded

Off List

F.o.b. Pittsburgh	35 and 2½ off
F.o.b. Chicago	35 off

STEEL AND WROUGHT PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio Mills

F.o.b. Pittsburgh only on wrought iron pipe.

Butt Weld

Steel			*Wrought Iron*		
Inches	Black	Galv.	Inches	Black	Galv.
⅛	+51	+29½	⅛	+91½	+138
¼ to ⅜	+53½	+35	¼ & ⅜	+1½	+21½
½	+58½	+47	½	+31½	+15
¾	+62	+52	¾	+36½	+20½
1 to 3	+64	+55	1 & 1¼	+39½	+25½
			1½	+43½	+28
			2	+41½	+26

Lap Weld

2	+60	+51	2	+37	+22½
2½ to 3	+63	+54	2½ to 3½	+38	+25
3½ to 6	+65	+56	4 to 8	+40	+28½
7 and 8	+64	+54	9 to 12	+38	+24½
9 and 10	+63½	+53½			
11 and 12	+62½	+52½			

Butt Weld, extra strong, plain ends

¼	+48½	+33½	¼	+13	+45½
⅜ to ⅜	+51	+38	¼ & ⅜	+2½	+34½
½	+56½	+47½	½	+32½	+17½
¾	+61	+52	¾	+37½	+22½
1 to 3	+63	+55	1 to 2	+43½	+29

Lap Weld, extra strong, plain ends

2	+58	+50	2	+40	+26
2½ to 3	+62	+54	2½ to 4	+45½	+33
3½ to 6	+65½	+57½	4½ to 6	+45	+33½
7 and 8	+64½	+54½	7 & 8	+46	+33
9 and 10	+63½	+53½	9 to 12	+41½	+30
11 and 12	+62½	+52½			

On standard steel pipe an extra 5% off is allowed on sales to consumers while two 5's off apply on sales to jobbers. On less-than-carload shipments prices are determined by adding 20 and 25% and the carload freight rate to the base card. On structural steel pipe the base card is reduced 2 points and two 5's off are allowed to consumers and three 5's off to jobbers.

Note—Chicago district mills have a base two points less than the above discounts. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Seamless Steel Commercial Boiler Tubes and Locomotive Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh in carload lots)

		Cold Drawn	Hot Rolled
1 in. o.d.	13 B.W.G.	$ 8.60	$ 7.82
1¼ in. o.d.	13 B.W.G.	10.19	9.26
1½ in. o.d.	13 B.W.G.	11.26	10.23
1¾ in. o.d.	13 B.W.G.	12.81	11.64
2 in. o.d.	13 B.W.G.	14.35	13.04
2¼ in. o.d.	13 B.W.G.	16.00	14.54
2½ in. o.d.	12 B.W.G.	17.61	16.01
2¾ in. o.d.	12 B.W.G.	19.29	17.54
2⅞ in. o.d.	12 B.W.G.	20.45	18.59
3 in. o.d.	12 B.W.G.	21.45	19.50
4½ in. o.d.	10 B.W.G.	41.08	37.35
3½ in. o.d.	11 B.W.G.	27.09	24.63
4 in. o.d.	10 B.W.G.	33.60	30.54
4½ in. o.d.	10 B.W.G.	41.08	37.35
5 in. o.d.	9 B.W.G.	51.56	46.87
6 in. o.d.	7 B.W.G.	79.15	71.90

Extras for less-carload quantities:

25,000 lb. or ft. to 39,999 lb. or ft.	5 %
12,000 lb. or ft. to 24,999 lb. or ft.	12½ %
6,000 lb. or ft. to 11,999 lb. or ft.	25 %
2,000 lb. or ft. to 5,999 lb. or ft.	35 %
Under 2,000 lb. or ft.	50 %

Lapweld Steel and Knobbed Charcoal Iron Pressure Tubes

(Net base prices per 100 ft. f.o.b. Pittsburgh, in carload lots)

		Steel	Iron
1¼ in. o.d.	13 B.W.G.	$ 9.72	$20.16
1½ in. o.d.	13 B.W.G.	11.06	21.84
2 in. o.d.	13 B.W.G.	12.38	17.23
2¼ in. o.d.	13 B.W.G.	13.79	19.58
2½ in. o.d.	12 B.W.G.	16.58	24.19
2¾ in. o.d.	12 W.B.G.	17.54	26.40
3 in. o.d.	12 B.W.G.	18.35	28.39
3½ in. o.d.	11 B.W.G.	21.56	33.95
3½ in. o.d.	11 B.W.G.	23.15	36.16
4 in. o.d.	10 B.W.G.	28.66	45.36
4½ in. o.d.	10 B.W.G.	35.22	56.48
5 in. o.d.	9 B.W.G.	44.25	61.86
6 in. o.d.	7 B.W.G.	68.14	102.46

Quantity Extras:

40,000 lb. or ft.	base
25,000 lb. or ft. to 39,999 lb. or ft.	plus 5%
10,000 lb. or ft. to 24,999 lb. or ft.	plus 13½%
2,000 lb. or ft. to 9,999 lb. or ft.	plus 25%
Under 2,000 lb. or ft.	plus 40%

CAST IRON WATER PIPE

Per Net Ton

*6-in. and larger, del'd Chicago	$48.40
*4-in., del'd Chicago	51.40
6-in. and larger, del'd New York	45.20
4-in., del'd New York	48.20
*6-in. and larger, Birmingham	40.00
*4-in. Birmingham	43.00
6-in. and larger, f.o.b. dock, San Francisco or Los Angeles	48.00
F.o.b. dock, Seattle	48.50
4-in., f.o.b. dock, San Francisco or Los Angeles	51.00
F.o.b. dock, Seattle	51.50

Class "A" and gas pipe, $3 extra.

*Prices for lots of less than 200 tons. For 200 tons and over, 6-in. and larger is $39, Birmingham, and $47.40, delivered Chicago, and 4-in. pipe, $42, Birmingham, and $50.40 a ton, delivered Chicago.

RAILROAD MATERIALS

Rails and Track Supplies

F.o.b. Mill

Standard rails, heavier than 60 lb. per gross ton	$36.37½
Angle bars, per 100 lb.	2.55

F.o.b. Code Basing Points

Light rails (from billets) per gross ton	$35.00
Light rails (from rail steel) per gross ton	34.00

Base per 100 Lb.

Spikes, 9/16 in. and larger	$2.40
Spikes, ½ and smaller	2.40
Tie plates, steel	1.90
Tie plates, Pacific Coast ports	2.00
Track bolts, to steam railroads	3.35
Track bolts, to jobbers, all sizes (per 100 count)	70 per cent off list

Basing points on light rails are Pittsburgh, Chicago and Birmingham; on spikes and tie plates, Pittsburgh, Chicago, Buffalo, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., Birmingham and Pacific Coast ports; on tie plates alone, Steelton, Pa.; on spikes alone, Cleveland, Youngstown, Lebanon, Pa., Columbia, Pa., Richmond, Va.

BOLTS, NUTS, RIVETS AND SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Of List
Machine bolts	75
Carriage bolts	75
Lag bolts	75
Plow bolts, Nos. 1, 2, 3 and 7 heads	75
Hot-pressed nuts, blank or tapped, square	75
Hot-pressed nuts, blank or tapped, hexagon	75
C.p.c. and t. square or hex. nuts, blank or tapped	75
Semi-finished hexagon nuts, U.S.S. and S.A.E., all sizes to and incl. 1 in. diameter	75
Larger than 1 in. diameter	75
Stove bolts in packages, Pittsburgh	75
Stove bolts in packages, Chicago	75
Stove bolts in packages, Cleveland	75
Stove bolts in bulk, Pittsburgh	80
Stove bolts in bulk, Chicago	80
Stove bolts in bulk, Cleveland	83
Tire bolts	60

Large Rivets

(½-in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh or Cleveland	$2.90
F.o.b. Chicago	3.00
F.o.b. Birmingham	3.05

Small Rivets

(7/16-in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh	70 and 5
F.o.b. Cleveland	70 and 5
F.o.b. Chicago and Birm'g'm	70 and 5

Cap and Set Screws

(Freight allowed up to but not exceeding 65c. per 100 lb. on lots of 200 lb. or more)

	Per Cent Off List
Milled cap screws, 1 in. dia. and smaller	80, 10 and 10
Milled standard set srews, case hardened, 1 in. dia. and smaller	75
Milled headless set screws, cut thread ⅝ in. and smaller	75
Upset hex. head cap screws, U.S.S. or S.A.E. thread, 1 in. dia and smaller	85
Upset set screws, cut and oval points	75 and 10
Milled studs	65 to 65 and 10

Alloy and Stainless Steel

Alloy Steel Ingots

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem. Uncropped ..... $40 per gross ton

Alloy Steel Blooms, Billets and Slabs

F.o.b. Pittsburgh, Chicago, Canton, Massillon, Buffalo, Bethlehem. Base price, $49 a gross ton.

Alloy Steel Bars

Price del'd Detroit is $52.

F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.

Open-hearth grade, base	2.45c.
Delivered price at Detroit is	2.60c.

S.A.E. Series Numbers	Alloy Differential per 100 lb.
2000 (1¼% Nickel)	$0.25
2100 (2½% Nickel)	0.55
2300 (3½% Nickel)	1.50
2500 (5% Nickel)	2.25
3100 Nickel Chromium	0.55
3200 Nickel Chromium	1.35
3300 Nickel Chromium	3.80
3400 Nickel Chromium	3.20
4100 Chromium Molybdenum (0.15 to 0.25 Molybdenum)	0.50
4100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4600 Nickel Molybdenum (0.20 to 0.30 Molybdenum) (1.50 to 2.00 Nickel)	1.05
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45
5100 Chromium Spring Steel	base
6100 Chromium Vanadium Bar	1.20
6100 Chromium Vanadium Spring Steel	0.70
Chromium Nickel Vanadium	1.50
Carbon Vanadium	0.95

These prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. The differential for cold-drawn bars ½c. per lb. higher with separate extras. Blooms, billets and slabs under 4x4 in. or equivalent are sold on the bar base. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base. Sections 4x4 in. to 10x10 in. or equivalent carry a gross ton price, which is the net price for bars for the same analysis. Larger sizes carry extras.

Alloy Cold-Finished Bars

F.o.b. Pittsburgh, Chicago, Gary, Cleveland or Buffalo. 2.95c. base per lb.

STAINLESS STEEL No. 302

(17 to 19% Cr. 7 to 9% NI. 0.08 to 0.20% C.)

(Base Prices f.o.b. Pittsburgh)

	Per Lb.
Forging billets	19.55c.
Rerolling slabs	15c.
Bars	23c.
Plates	26c.
Structural shapes	23c.
Sheets	33c.
Hot-rolled strip	20¾c.
Cold-rolled strip	27c.
Drawn wire	23c.

Raw and Semi-Finished Steel

Carbon Steel Rerolling Ingots

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham. Uncropped ..... $29 per gross ton

Carbon Steel Forging Ingots

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Birmingham. Uncropped ..... $31 per gross ton

Billets, Blooms and Slabs

F.o.b. Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham.

	Per Gross Ton
Rerolling	$27.00
Forging quality	35.00

Delivered Detroit

Rerolling	$30.00
Forging	38.00

Billets Only F.o.b. Duluth

Rerolling	$29.00
Forging	37.00

Sheet Bars

F.o.b. Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open-hearth or Bessemer	$28.00

Skelp

F.o.b. Pittsburgh, Chicago, Youngstown, Buffalo, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved	1.75c.
Universal	1.75c.
Sheared	1.75c.

Wire Rods

(Common, base)

	Per Gross Ton
F.o.b. Pittsburgh	$32.00
F.o.b. Cleveland	32.00
F.o.b. Chicago	30.00
F.o.b. Anderson, Ind.	30.00
F.o.b. Youngstown	32.00
F.o.b. Worcester, Mass.	40.00
F.o.b. Birmingham	41.00
F.o.b. San Francisco	47.00
F.o.b. Galveston	44.00

Pig Iron and Ferroalloys

PIG IRON

PRICES PER GROSS TON AT BASING POINTS

Basing Points	No. 2 Fdry.	Malleable	Basic	Bessemer
Everett, Mass.	$19.50	$20.00	$19.00	$20.50
Bethlehem, Pa.	19.50	20.00	19.00	20.50
Birdsboro, Pa.	19.50	20.00	19.00	20.50
Swedeland, Pa.	19.50	20.00	19.00	20.50
Steelton, Pa.	....	....	19.00	....
Sparrows Point, Md.	19.50	....	19.00	....
Neville Island, Pa.	18.50	18.50	18.00	19.00
Sharpsville, Pa.	18.50	18.50	18.00	19.00
Youngstown	18.50	18.50	18.00	19.00
Buffalo	18.50	19.00	17.50	19.50
Erie, Pa.	18.50	19.00	18.00	19.50
Cleveland	18.50	18.50	18.00	19.00
Toledo, Ohio	18.50	18.50	18.00	19.00
Jackson, Ohio	20.25	20.25	19.75	20.75
Detroit	18.50	18.50	18.00	19.00
Hamilton, Ohio	18.50	18.50	18.00	19.00
Chicago	18.50	18.50	18.00	19.00
Granite City, Ill.	18.50	18.50	18.00	....
Duluth, Minn.	19.00	19.00	....	19.50
Birmingham	14.50	14.50	13.50	19.00
Provo, Utah	17.50	....	17.00	....

DELIVERED PRICES PER GROSS TON AT CONSUMING CENTERS

	No. 2 Fdry.	Malleable	Basic	Bessemer
Boston Switching District From Everett, Mass.	$20.00	$20.50	$19.50	$21.00
Brooklyn From East. Pa.	21.9289	22.4289	21.9289	22.9289
Newark or Jersey City, N. J. From East. Pa.	20.9873	21.4873	20.4873	21.9873
Philadelphia From Eastern Pa.	20.3132	20.8132	19.8132	21.3132
Cincinnati From Hamilton, Ohio	19.5807	19.5807	19.0807	20.0807
Canton, Ohio From Cleveland and Youngstown	19.3402	19.3402	19.3402	20.3402
Columbus, Ohio From Hamilton, Ohio	20.64	20.64	....	....
Mansfield, Ohio From Cleveland and Toledo	20.3832	20.3832	....	....
Indianapolis From Hamilton, Ohio	20.9289	20.9289	....	....
South Bend, Ind. From Chicago	20.6935	20.6935	....	....
Milwaukee From Chicago	19.57	19.57	....	....
St. Paul From Duluth	20.94	....	....	....
Davenport, Iowa From Chicago	20.3832	20.3832	....	....
Kansas City From Granite City	21.2178	21.2178	....	....
San Francisco, Los Angeles or Seattle. From Provo	22.315	....	....	....

Delivered prices on Southern iron for shipment to Northern points are 38c. a gross ton below delivered prices from the nearest Northern basing points.

LOW PHOSPHORUS PIG IRON

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y. $23.50

GRAY FORGE PIG IRON

Valley furnace	$18.00
Pittsburgh district furnace	18.00

CHARCOAL PIG IRON

Lake Superior furnace	$21.50
Delivered Chicago	24.7528
Delivered Buffalo	25.095

CANADA

Pig Iron

Per gross ton:

Delivered Toronto

No. 1 fdy., sil. 2.25 to 2.75	$21.00
No. 2 fdy., sil. 1.75 to 2.25	20.50
Malleable	21.00

Delivered Montreal

No. 1 fdy., sil. 2.25 to 2.75	$22.50
No. 2 fdy., sil. 1.75 to 2.25	22.00
Malleable	22.50
Basic	22.00

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans.

	Per Gross Ton
Domestic, 80% (carload)	$85.00

Spiegeleisen

	Per Gross Ton Furnace
Domestic, 19 to 21%	$26.00
50-ton lots 3-mo. shipment	24.00
F.o.b. New Orleans	26.00

Electric Ferrosilicon

		Per Gross Ton Delivered
50%	(carloads)	$77.50
50%	(ton lots)	85.00
75%	(carloads)	126.00
75%	(ton lots)	136.00

Silvery Iron

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
6%	$22.75	12%	$26.25
7%	22.75	13%	26.75
8%	24.75	14%	27.25
9%	25.75	15%	33.75
10%	26.75	16%	35.25
11%	27.75	17%	36.75

The lower all-rail delivered price from Jackson or Buffalo is quoted with freight allowed. Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Manganese 2 to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional.

Bessemer Ferrosilicon

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		*Per Gross Ton*	
10%	$27.75	14%	$28.25
11%	28.75	15%	34.75
12%	30.25	16%	36.25
13%	31.75	17%	37.75

Manganese 2 to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 ton additional.

Base prices at Buffalo are $1.25 a ton higher than at Jackson.

Other Ferroalloys

Ferrotungsten, per lb. contained W. del., carloads	$1.35 to $1.45
Ferrotungsten, less carloads	1.45 to 1.55
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr. per lb. contained Cr. delivered, in carloads	16.00c.
Ferrochromium, 2% carbon	16.50c. to 17.00c.
Ferrochromium, 1% carbon	17.50c. to 18.00c.
Ferrochromium, 0.10% carbon	19.50c. to 20.00c.
Ferrochromium, 0.06% carbon	20.00c. to 20.50c.
Ferrovanadium, del. per lb. contained V.	$2.70 to $2.90
Ferrocarbontitanium, 15 to 18% Ti, 6 to 8% C. f.o.b. furnace carload and contract per net ton	$137.50
Ferrophosphorus, electric, or blast furnace material, in carloads, 18%, Rockdale, Tenn., base, per gross ton with $3 unitage	50.00
Ferrophosphorus, electric, 24%, f.o.b. Anniston, Ala., per gross ton with $2.75 unitage	85.00
Ferromolybdenum, per lb. Mo., del.	95c.
Calcium molybdate, per lb. Mo., del.	80c.
Silico spiegel, per ton, f.o.b. furnace, carloads	$38.00
Ton lots or less, per ton	45.50
Silico-manganese, gross ton, delivered. 2.50% carbon grade	90.00
2% carbon grade	95.00
1% carbon grade	105.00
Spot prices	$5 a ton higher

Iron and Steel Scrap

PITTSBURGH

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$13.25 to $13.75
No. 2 heavy melting steel	12.00 to 12.50
No. 2 railroad wrought	13.50 to 14.00
Scrap rails	14.25 to 14.75
Rails, 3 ft. and under	15.50 to 16.00
Compressed sheet steel	12.25 to 12.75
Hand bundled sheet steel	12.00 to 12.50
Hvy. steel axle turnings	11.50 to 12.00
Machine shop turnings	9.50 to 10.00
Short shov. turnings	9.50 to 10.00
Short mixed borings and turnings	8.50 to 9.00
Cast iron borings	8.50 to 9.00
Cast iron carwheels	14.00 to 14.50
Heavy breakable cast	12.25 to 12.75
No. 1 cast	14.00 to 14.50
Railr. knuckles and couplers	15.00 to 15.50
Rail. coil and leaf springs	15.50 to 16.00
Rolled steel wheels	15.50 to 16.00
Low. phos. billet crops	16.50 to 17.00
Low phos. sheet bar crops	16.50 to 16.00
Low phos. punchings	15.00 to 15.50
Low phos. plate scrap	14.50 to 15.00
Steel car axles	14.50 to 15.00

CHICAGO

Delivered Chicago district consumers:

	Per Gross Ton
Heavy melting steel	$12.25 to $12.75
Automobile hvy. melt. steel	11.25 to 11.75
Shoveling steel	12.25 to 12.75
Hydraulic comp. sheets	11.25 to 11.75
Drop forge flashings	9.50 to 10.00
No. 1 busheling	11.00 to 11.50
Rolled carwheels	12.75 to 13.25
Railroad tires	13.00 to 13.50
Railroad leaf springs	12.75 to 13.25
Axle turnings	11.00 to 11.50
Steel couplers and knuckles	13.25 to 13.75
Coil springs	14.25 to 14.75
Axle turnings (elec. fur.)	11.75 to 12.25
Low phos. punchings	14.50 to 15.00
Low phos. plates, 12 in. and under	14.50 to 15.00
Cast iron borings	6.00 to 6.50
Short shoveling turnings	7.50 to 8.00
Machine shop turnings	7.00 to 7.50
Rerolling rails	13.00 to 14.00
Steel rails, less than 3 ft.	13.50 to 14.00
Steel rails, less than 2 ft.	15.00 to 15.50
Angle bars, steel	14.00 to 14.50
Cast iron carwheels	12.75 to 13.25
Railroad malleable	14.75 to 15.25
Agricultural malleable	10.25 to 10.75

	Per Net Ton
Iron car axles	$15.50 to $16.00
Steel car axles	14.75 to 15.25
No. 1 railroad wrought	9.50 to 10.00
No. 2 railroad wrought	11.00 to 11.50
No. 2 busheling	6.50 to 7.00
Locomotive tires, smooth	11.50 to 12.00
Pipes and flues	7.00 to 7.50
No. 1 machinery cast	11.25 to 11.75
Clean automobile cast	10.50 to 11.00
No. 1 railroad cast	9.50 to 10.00
No. 1 agricultural cast	9.75 to 10.25
Stove plate	8.00 to 8.50
Grate bars	8.00 to 8.50
Brake shoes	8.00 to 8.50

PHILADELPHIA

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$12.00
No. 2 heavy melting steel	$11.00 to 11.50
Hydraulic compressed, new	10.00 to 10.50
Hydraulic compressed, old	8.50 to 9.00
Steel rails for rolling	14.00 to 14.50
Cast iron carwheels	12.50 to 13.00
Heavy breakable cast	11.25 to 11.50
No. 1 cast	12.50 to 13.00
Stove plate (steel works)	9.00 to 9.50
Machine shop turnings	7.50 to 8.00
No. 1 blast furnace	5.50 to 6.00
Heavy axle turnings	9.50 to 10.00
Cast borings	5.00 to 5.50
No. 1 low phos. heavy	14.50 to 15.00
Couplers and knuckles	14.50 to 15.00
Rolled steel wheels	14.50 to 15.00
Steel axles	16.00 to 16.50
Shafting	18.00 to 18.50
No. 1 railroad wrought	12.00 to 12.50
Spec. iron and steel pipe	9.50 to 10.00
Bundled sheets	9.50 to 10.00
No. 1 forge fire	10.50 to 11.00
Cast borings (chem.)	10.50 to 13.00

CINCINNATI

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	$10.00 to $10.50
No. 2 heavy melting steel	8.00 to 8.50
Scrap rails for melting	9.25 to 9.75
Loose sheet clippings	6.00 to 6.50
Bundled sheets	7.25 to 7.75
Cast iron borings	5.50 to 6.00
Machine shop turnings	5.75 to 6.25
No. 1 busheling	7.25 to 7.75
No. 2 busheling	3.75 to 4.25
Rails for rolling	10.25 to 10.75
No. 1 locomotive tires	8.50 to 9.00
Short rails	13.00 to 13.50
Cast iron carwheels	9.50 to 10.00
No. 1 machinery cast	10.50 to 11.00
No. 1 railroad cast	9.75 to 10.25
Burnt cast	7.25 to 7.75
Stove plate	7.25 to 7.75
Agricultural malleable	9.25 to 9.75
Railroad malleable	10.50 to 11.00

CLEVELAND

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$12.25 to $12.50
No. 2 heavy melting steel	11.25 to 11.50
Compressed sheet steel	11.00 to 11.50
Light bundled sheet stampings	9.25 to 9.75
Drop forge flashings	10.50 to 11.00
Machine shop turnings	7.75 to 8.25
Short shoveling turnings	8.00 to 8.50
No. 1 busheling	10.50 to 11.00
Steel axle turnings	10.50 to 11.00
Low phos. billet crops	15.00 to 15.50
Cast iron borings	7.75 to 8.25
Mixed borings and short turnings	7.75 to 8.25
No. 2 busheling	7.75 to 8.25
No. 1 cast	13.50 to 14.00
Railroad grate bars	7.00 to 7.50
Stove plate	7.50 to 8.00
Rails under 3 ft.	15.50 to 16.00
Rails for rolling	15.50 to 16.00
Railroad malleable	15.50 to 16.00
Cast iron carwheels	10.75 to 11.00

BUFFALO

Per gross ton, f.o.b. Buffalo consumers' plants:

No. 1 heavy melting steel	$12.00 to $12.50
No. 2 heavy melting scrap	11.00 to 11.50
Scrap rails	12.00 to 12.50
New hydraul. comp. sheets	11.00 to 11.50
Old hydraul. comp. sheets	9.50 to 10.00
Drop forge flashings	10.50 to 11.00
No. 1 busheling	11.00 to 11.50
Hvy. steel axle turnings	10.50 to 11.00
Machine shop turnings	5.50 to 6.00
Knuckles and couplers	13.00 to 14.00
Coil and leaf springs	13.00 to 14.00
Rolled steel wheels	13.00 to 14.00
Low phos. billet crops	14.50 to 15.00
Short shov. steel turnings	7.50 to 8.00
Short mixed borings and turnings	7.50 to 8.00
Cast iron borings	7.50 to 8.00
No. 2 busheling	7.00 to 7.50
Steel car axles	12.50 to 13.00
Iron axles	12.50 to 13.00
No. 1 machinery cast	12.50 to 13.00
No. 1 cupola cast	11.50 to 12.00
Stove plate	10.00 to 10.50
Steel rails, 3 ft. and under	14.50 to 15.00
Cast iron carwheels	12.00 to 12.50
Railroad malleable	14.00 to 14.50
Chemical borings	9.00 to 9.50

BOSTON

Dealers' buying prices per gross ton:

*No. 1 heavy melting steel	$9.00 to $9.25
No. 1 heavy melting steel	7.15 to 7.40
*Scrap rails	9.25 to 9.50
Scrap rails	7.25 to 7.50
*No. 2 steel	8.00 to 8.25
No. 2 steel	6.15 to 6.40
Breakable cast	6.00 to 6.25
Machine shop turnings	3.50 to 3.65
Bundled skeleton, long	6.00 to 6.15
Forge flashings	6.00 to 6.15
Shafting	13.00 to 13.25
Steel car axles	12.50 to 13.00
Cast iron borings, chemical	5.00 to 7.00

Per gross ton delivered consumers' yards:

Textile cast	9.50 to 10.00
No. 1 machinery cast	9.00 to 9.50
Stove plate	6.00 to 6.50
Railroad malleable	11.00 to 11.50

* Delivered local army base.

NEW YORK

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	$8.50 to $8.75*
No. 2 heavy melting steel	7.50 to 7.75*
Heavy breakable cast	6.75 to 7.25
No. 1 machinery cast	7.00 to 7.50
No. 2 cast	6.50
Stove plate	6.00 to 6.50
Steel car axles	13.50 to 14.00
Shafting	13.50 to 13.75
No. 1 railroad wrought	7.75 to 8.25
No. 1 yard wrought, long	6.75 to 7.25
Spec. iron and steel pipe	5.50 to 6.00
Forge fire	6.50 to 7.00
Rails for rolling	9.00 to 10.00
Short shoveling turnings	3.00 to 3.25
Machine shop turnings	3.50 to 4.00
Cast borings	3.50 to 3.75
No. 1 blast furnace	2.00 to 2.50
Cast borings (chemical)	11.00 to 11.50
Unprepared yard iron and steel	4.50 to 5.00

Per gross ton, delivered local foundries:

No. 1 machinery cast	$10.50
No. 1 hvy. cast (cupola size)	9.50
No. 2 cast	8.00

† Loading on barge.
*25c. higher offered to nearby New Jersey points.

BIRMINGHAM

Per gross ton delivered consumers' yards:

Heavy melting steel	$7.50 to $8.00
Scrap steel rails	10.00 to 10.50
Short shoveling turnings	7.00
Stove plates	7.00
Steel axles	11.50
Iron axles	11.50
No. 1 railroad wrought	7.00
Rails for rolling	12.50
No. 1 cast	10.00 to 10.50
Tramcar wheels	10.00

ST. LOUIS

Dealers' buying prices per gross ton:

Selected heavy steel	$10.50 to $11.00
No. 1 heavy melting	10.00 to 10.50
No. 2 heavy melting	8.50 to 9.00
No. 1 locomotive tires	9.75 to 10.25
Misc. stand-sec. rails	11.50 to 12.00
Railroad springs	12.00 to 12.50
Bundled sheets	6.50 to 7.00
No. 2 railroad wrought	10.00 to 10.50
No. 1 busheling	5.00 to 5.50
Cast iron borings and shoveling turnings	3.00 to 3.50
Rails for rolling	12.00 to 12.50
Machine shop turnings	2.75 to 3.25
Heavy turnings	8.00 to 8.50
Steel car axles	13.50 to 13.00
Iron car axles	15.00 to 16.00
No. 1 railroad wrought	7.00 to 7.50
Steel rails less than 3 ft.	13.00 to 13.50
Steel angle bars	12.00 to 12.50
Cast iron carwheels	9.00 to 9.50
No. 1 machinery cast	9.50 to 10.00
Railroad malleable	12.50 to 13.00
No. 1 railroad cast	9.00 to 9.50
Stove plate	6.50 to 7.00
Agricult. malleable	8.50 to 9.00

DETROIT

Dealers' buying prices per gross ton:

Heavy melting steel	$9.50 to $10.00
Borings and short turnings	5.75 to 6.25
Long turnings	$5.75 to $6.25
No. 1 machinery cast	12.50 to 13.00
Automotive cast	13.00 to 13.50
Hydraulic comp. sheets	10.25 to 10.75
Stove plate	7.75 to 8.25
New factory busheling	9.00 to 9.50
Old No. 2 busheling	5.25 to 5.75
Sheet clippings	7.00 to 7.50
Flashings	8.50 to 9.00
Low phos. plate scrap	10.25 to 10.75

CANADA

Dealers' buying prices per gross ton:

	Toronto	Montreal
Heavy melting steel	$8.00	$7.50
Rails, scrap	8.50	8.00
Machine shop turnings	3.50	3.50
Boiler plate	5.00	5.00
Heavy axle turnings	4.50	4.00
Cast borings	4.50	4.00
Steel borings	3.00	3.00
Wrought pipe	4.00	4.00
Steel axles	8.00	8.50
Axles, wrought iron	8.00	8.50
No. 1 machinery cast	9.50	9.00
Stove plate	6.50	6.00
Standard carwheels	7.75	7.00
Malleable	7.50	7.00

ORES, FLUORSPAR, COKE, FUEL, REFRACTORIES

Lake Superior Ores

Delivered Lower Lake Ports

	Per Gross Ton
Old range, Bessemer, 51.50% iron	$4.80
Old range, non-Bessemer, 51.50% iron	4.65
Mesabi, Bessemer, 51.50% iron	4.65
Mesabi, non-Bessemer, 51.50% iron	.50
High phosphorus, 51.50% iron	4.40

Foreign Ore

C.i.f. Philadelphia or Baltimore

	Per Unit
Iron, low phos., copper free, 55 to 58% iron, dry Spanish or Algeria	10.50c.
Iron, low phos., Swedish, average 68½% iron	10.50c.
Iron, basic or foundry, Swedish, aver. 65% iron	9.50c.
Iron, basic or foundry, Russian, aver. 65% iron	9.50c.
Manganese, Caucasian, washed 52%	26c.
Manganese, African, Indian, 44-48%	22c.
Manganese, African, Indian, 49-51%	24c.
Manganese, Brazilian, 46 to 48½%	20c.

	Per Net Ton Unit
Tungsten, Chinese, wolframite, duty paid, delivered	$15.50 to $16.00
Tungsten, domestic, scheelite, delivered	15.00

	Per Gross Ton
Chrome, 45% Cr_2O_3, lump, c.i.f. Atlantic Seaboard (African)	$17.50
45 to 46% Cr_2O_3 (Turkish)	$16.00 to 16.50
48% Cr_2O_3 (African)	20.50
48% min. Cr_2O_3 (Turkish)	19.25
Chrome concentrate, 50% and over Cr_2O_3, c.i.f. Atlantic Seaboard	22.00
52% Cr_2O_3 (Turkish)	21.75
48 to 49% Cr_2O_3 (Turkish)	19.25

Fluorspar

	Per Net Ton
Domestic, washed gravel, 85-5, f.o.b. Kentucky and Illinois mines for all-rail shipment	$14.00 to $15.00
Same grade for Ohio River barge shipment for Kentucky and Illinois River landings	15.00
No. 2 lump, 85-5, f.o.b. Kentucky and Illinois mines	14.00 to 15.00
Foreign, 85% calcium fluoride, not over 5% silicon, c.i.f. Atlantic ports, duty paid	18.50
Domestic, No. 1 ground bulk, 95 to 98% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	30.00

COKE, COAL AND FUEL OIL

Coke

	Per Net Ton
Furnace, f.o.b. Connellsville Prompt	$3.60 to $3.75
Foundry, f.o.b. Connellsville Prompt	4.25 to 5.75
Foundry, by-product, Chicago ovens, for delivery outside switching district	9.00
Foundry, by-product, delivered in Chicago switching district	9.75
Foundry, by-product, New England, delivered	11.00
Foundry, by-product, Newark or Jersey City, del'd	9.24 to 9.72
Foundry, by-product, Philia.	9.03
Foundry, by-product, Cleveland, delivered	9.75
Foundry, Birmingham	6.00
Foundry, by-product, St. Louis, f.o.b. ovens	$8.00
Foundry, by-product, del'd St. Louis	9.00
Foundry, from Birmingham, f.o.b. cars docks, Pacific ports	14.75

Coal

	Per Net Ton
Mine run steam coal, f.o.b. W. Pa. mines	$1.60 to $1.80
Mine run coking coal, f.o.b. W. Pa.	1.90 to 2.10
Gas coal, ¾-in., f.o.b. Pa. mines	2.00 to 2.50
Mine run gas coal, f.o.b. Pa. mines	1.90 to 2.10
Steam slack, f.o.b. W. Pa. mines	1.15 to 1.40
Gas slack, f.o.b. W. Pa. mines	1.35 to 1.60

Fuel Oil

	Per Gal. f.o.b. Bayonne, N. J.
No. 3 distillate	4.25c.
No. 4 industrial	3.87½c.

	Per Gal. f.o.b. Baltimore
No. 3 distillate	4.25c.
No. 4 industrial	3.87½c.

	Per Gal. del'd Chicago
No. 3 industrial fuel oil	4.75c.
No. 5 industrial fuel oil	3.75c.

	Per Gal. f.o.b. Cleveland
No. 3 distillate	5.25c.
No. 4 industrial	5.12½c.
No. 5 industrial	4.00c

REFRACTORIES

Fire Clay Brick

	Per 1000 f.o.b. Works: High-heat Duty Brick	Intermediate Duty Brick
Pennsylvania	$45.00	$40.00
Maryland	5.00	40.00
New Jersey	50.00	45.00
Ohio	45.00	40.00
Kentucky	45.00	40.00
Missouri	45.00	40.00
Illinois	45.00	40.00
Ground fire clay, per ton	7.00	

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$45.00
Chicago District	54.00
Birmingham	55.00
Silica clay, per net ton	3.00

Chrome Brick

	Per Net Ton
Standard, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	$45.00
Chemically bonded f.o.b. Baltimore, Plymouth Meeting and Chester, Pa.	45.00

Magnesite Brick

	Per Net Ton
Standard, f.o.b. Baltimore and Chester, Pa.	$45.00
Chemically bonded, f.o.b. Baltimore	55.00

Grain Magnesite

	Per Net Ton
Imported f.o.b. Baltimore and Chester, Pa.	$45.00
Domestic, f.o.b. Baltimore and Chester	40.00
Domestic, f.o.b. Chewelah, Wash.	22.00

Warehouse Prices for Steel Products

PITTSBURGH

Base per Lb.

Plates	3.15c.
Structural shapes	3.15c.
Soft steel bars and small shapes	2.95c.
Reinforcing steel bars	2.90c.
Cold-finished and screw stock:	
Rounds and hexagons	3.20c.
Squares and flats	3.20c.
Hoops and bands under ¼ in.	3.20c.
Hot-rolled annealed sheets (No. 24), 25 or more bundles	3.30c.
Galv. sheets (No. 24), 25 or more bundles	3.95c.
Hot-rolled sheets (No. 10)	2.95c.
Galv. corrug. sheets (No. 28), per square (more than 3750 lb.)	$3.69
Spikes, large	2.90c.
Track bolts, all sizes, per 100 count, 65 per cent off list.	
Machine bolts, 100 count, 65 per cent off list.	
Carriage bolts, 100 count, 65 per cent off list.	
Nuts, all styles, 100 count, 65 per cent off list.	
Large rivets, base per 100 lb.	$3.50
Wire, black, soft ann'l'd, base per 100 l.b	*2.70
Wire, galv. soft, base per 100 lb.	*2.925
Common wire nails, per keg	*2.834
Cement coated nails, per keg	*2.834

On plates, structurals, bars, reinforcing bars, bands, hoops and blue annealed sheets, base applies to orders of 400 to 9999 lbs.

*Delivered in Pittsburgh switching district.

CHICAGO

Base per Lb.

Plates and structural shapes	3.20c.
Soft steel bars, rounds	3.00c.
Soft steel bars, squares and hexagons	3.15c.
Cold-fin. steel bars:	
Rounds and hexagons	3.35c.
Flats and squares	3.35c.
Hot-rolled strip	3.30c.
Hot-rolled annealed sheets (No. 24)	3.85c.
Galv. sheets (No. 24)	4.55c.
Hot-rolled sheets (No. 10)	3.05c.
Spikes (keg lots)	3.50c.
Track bolts (keg lots)	4.65c.
Rivets, structural (keg lots)	3.65c.
Rivets, boiler (keg lots)	3.75c.

Per Cent Off List

Machine bolts	*70
Carriage bolts	*70
Lag screws	*70
Hot-pressed nuts, sq. tap. or	
Hot-pressed nuts, sq. tap or blank	*70
Hot-pressed nuts, hex. tap or	
Hot-pressed nuts, hex. tap or blank	*70
Hex. head cap screws	87½
Cut point set screws	80
Flat head bright wood screws..50 and	20
Spring cotters	55
Stove bolts in full packages	70
Rd. hd. tank rivets, 7/16 in. and smaller	57½
Wrought washers	$4.50 off list
Black ann'l'd wire per 100 lb.	$3.85
Com. wire nails, base per keg	2.95†
Cement c't'd nails, base per keg	2.95†

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. All prices are f.o.b. consumers' plants within the Chicago switching district.

*These are quotations delivered to city trade for quantities of 100 lb. or more. For lots of less than 100 lb., the quotation is 65 per cent off. Discounts applying to country trade are 70 per cent off, f.o.b. Chicago, with full or partial freight allowed up to 50c. per 100 lb.

†Prices for city and suburbs only.

NEW YORK

Base per Lb.

Plates, ¼ in. and heavier	3.40c.
Structural shapes	3.37c.
Soft steel bars, rounds	3.31c.
Iron bars	3.26c.
Iron bars, swed. charcoal	6.75c. to 7.00c.
Cold-fin. shafting and screw stock:	
Rounds and hexagons	3.81c.
Flats and squares	3.81c.
Cold-rolled; strip, soft and quarter hard	3.36c.
Hoops	3.56c.
Bands	3.56c.
Hot-rolled sheets (No. 10)	3.31c.
Hot-rolled ann'l'd sheets (No. 24*)	3.89c.
Galvanized sheets (No. 24*)	special
Long terne sheets (No. 24)	5.25c.
Standard tool steel	11.00c.
Wire, black annealed (No. 10)	3.40c.
Wire, galv. (No. 10)	3.75c.
Tire steel, 1 x ⅛ in. and larger	3.75c.
Open hearth spring steel	4.00c. to 10.00c.
Common wire nails, base, per keg	$3.21

Per Cent Off List

Machine bolts, square head and nut:	
All diameters	70 and 10
Carriage bolts, cut thread:	
All diameters	65 and 10
Boiler tubes:	Per 100 Ft.
Lap welded, 2-in.	$18.05
Seamless welded, 2-in.	19.24
Charcoal iron, 2-in.	24.94
Charcoal iron 4-in.	63.65

*No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

ST. LOUIS

Base per Lb.

Plates and struc. shapes	3.45c.
Bars, soft steel (rounds and flats)	3.28c.
Bars, soft steel (squares, hexagons, ovals, half ovals and half rounds)	3.40c.
Cold-fin. rounds, shafting, screw stocks	3.60c.
Hot-rolled annealed sheets (No. 24)	4.10c.
Galv. sheets (No. 24)	4.65c.
Hot-rolled sheets (No. 10)	3.30c.
Black corrug. sheets (No. 24)	4.10c.
*Galv. corrug. sheets	4.65c.
Structural rivets	4.00c.
Boiler rivets	4.10c.

Per Cent Off List

Tank rivets, 7/16 in. and smaller	55
Machine and carriage bolts, lag screws, fitting up bolts, bolt ends, plow bolts, hot-pressed nuts, square and hexagon, tapped or blank, semi-finished nuts:	
All quantities	70

*No. 26 and lighter take special prices.

PHILADELPHIA

Base per Lb.

*Plates, ¼-in. and heavier	2.98c.
*Structural shapes	2.98c.
*Soft steel bars, small shapes, iron bars (except bands)	3.03c.
‡Reinforc. steel bars, sq. twisted and deformed	2.96c.
Cold-finished steel bars	3.61c.
*Steel hoops	3.43c.
*Steel bands, No. 12 and 3/16 in. incl.	3.18c.
Spring steel	5.00c.
†Hot-rolled aneal. sheets (No. 24)	3.65c.
†Galvanized sheets (No. 24)	4.40c.
*Hot-rolled annealed sheets (No. 10)	3.08c.
Diam. pat. floor plates, ¼ in.	4.95c.
Swedish iron bars	6.25c.

These prices are subject to quantity differentials except on reinforcing and Swedish iron bars.

*Base prices subject to deduction on orders aggregating 4000 lb. or over.

†For 50 bundles or over.

‡For less than 2000 lb.

CLEVELAND

Base per Lb.

Plates and struc. shapes	3.31c.
Soft steel bars	3.00c.
Reinforc. steel bars	2.10c.
Cold-finished steel bars	3.25c.
Flat-rolled steel under ¼ in.	3.36c.
Cold-finished strip	†3.00c.
Hot-rolled anealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 24)	4.61c.
Hot-rolled sheets (No. 10)	3.11c.
Hot-rolled 3/16 in. 24 to 48 in. wide sheets	3.56c.
*Black ann'l'd wire, per 100 lb.	$2.75
*No. 9 galv. wire, per 100 lb.	3.10
*Com. wire nails, base per keg	2.70

†Outside delivery 10c. less.

*For 5000 lb. or less.

CINCINNATI

Base per Lb.

Plates and struc. shapes	3.42c.
Bars, rounds, flats and angles	3.22c.
Other shapes	3.37c.
Rail steel reinfore. bars	3.25c.
Hoops and bands, 3/16 in. and lighter	3.47c.
Cold-finished bars	3.57c.
Hot-rolled annealed sheets (No. 24)	4.02c.
Galv. sheets (No. 24)	4.72c.
Hot-rolled sheets (No. 10)	3.22c.
Structural rivets	4.35c.
Small rivets	55 per cent off list
No. 9 ann'l'd wire, per 100 lb. (1000 lb. or over)	$2.88
Com. wire nails, base per keg:	
Any quantity less than carload	3.04
Cement c't'd nails, base 100-lb. keg.	3.50
Chain, 1in. per 100 lb.	3.35

Net per 100 Ft.

Seamless steel boiler tubes, 2-in.	$20.37
4-in.	48.14
Lap-welded steel boiler tubes, 2-in.	19.38
4-in.	45.32

BUFFALO

Base per Lb.

Plates	3.38c.
Struc. shapes	3.25c.
Soft steel bars	3.05c.
Reinforcing bars	2.60c.
Cold-fin. flats and sq.	3.40c.
Round and hex.	3.40c.
Cold-rolled strip steel	3.19c.
Hot-rolled annealed sheets (No. 24)	4.06c.
Heavy hot-rolled sheets (3/16 in., 24 to 48 in. wide)	3.63c.
Galv. sheets (No. 24)	4.70c.
Bands	3.43c.
Hoops	3.43c.
Heavy hot-rolled sheets	3.18c.
Com. wire nails, base per keg	$3.35
Black wire, base per 100 lb. (2500-lb. lots or under)	3.55
(Over 2500 lb.)	3.45

BOSTON

Base per Lb.

Beams, channels, angles, tees, zees	3.54c.
H beams and shapes	3.54c.
Plates—Sheered, tank and univ. mill, ¼ in. thick and heavier	3.56c.
Floor plates, diamond pattern	5.36c.
Bar and bar shapes (mild steel)	3.45c.
Bands 3/16 in. thick and No. 12 ga. incl.	3.65c. to 4.65c.
Half rounds, half ovals, ovals and bevels	4.70c.
Tire steel	4.70c.
Cold-rolled strip steel	3.245c.
Cold-finished rounds, squares and hexagons	3.90c.
Cold-finished flats	3.75c.
Blue annealed sheets, No. 10 ga.	3.65c.
One pass cold-rolled sheets No. 24 ga.	4.20c.
Galvanized steel sheets, No. 24 ga.	4.90c.
Lead coated sheets, No. 24 ga.	5.85c.

Prices delivered by truck in metropolitan Boston, subject to quantity differentials.

DETROIT

Base per Lb.

Soft steel bars	3.09c.
Structural shapes	3.42c.
Plates	3.42c.
Floor plates	5.17c.
Hot-rolled annealed sheets (No. 24)	3.94c.
Hot-rolled sheets (No. 10)	3.14c.
Galvanized sheets (No. 24)	4.72c.
Bands	3.39c.
Hoops	3.39c.
Cold-finished bars	3.49c.
Cold-rolled strip	3.18c.
Hot-rolled alloy steel (S.A.E. 3100 Series)	5.29c.*
Bolts and nuts	70 and 5 per cent off list

Prices delivered by truck in metropolitan Detroit, subject to quantity differentials.

*Price applies to 1,000 lb. and over.

MILWAUKEE

Base per Lb.

Plates and structural shapes	3.31c.
Soft steel bars, rounds	3.11c.
Soft steel bars, squares and hexagons	3.26c.
Hot-rolled strip	3.41c.
Hot-rolled sheets (No. 10)	3.16c.
Hot-rolled annealed sheets (No. 24)	3.96c.
Galvanized sheets (No. 20)	4.66c.
Cold-finished steel bars	3.46c.
Cold-rolled strip	3.33c.
Structural rivets (keg lots)	3.86c.
Boiler rivets, cone head (keg lots)	3.96c.
Boiler rivets, rd. head (keg lots)	3.86c.
Track spikes (keg lots)	3.71c.
Track bolts (keg lots)	4.86c.
*Black annealed wire	3.25c.
†Com. wire nails	2.95c.
Cement coated nails	2.90c.

Per Cent Off List

Machine bolts	70 and 10
Carriage bolts	70 and 10
Hot-pressed nuts, sq. and hex. tapped or blank (keg lots)	70 and 10

Prices given above are delivered Milwaukee.

On plates, shapes, bars, hot-rolled strip and heavy hot-rolled sheets, the base applies on orders of 400 to 9999 lb. On galvanized and No. 24 hot-rolled annealed sheets the prices given apply on orders of 400 to 1500 lb. On cold-finished bars the prices are for orders of 1000 lb. or more of a size.

*For quantities of 500 to 2500 lb. assorted black annealed and galvanized wire.

†For orders of 50 kegs or less.

ST. PAUL

Base per Lb.

Mild steel bars, rounds	3.20c.
Structural shapes	3.45c.
Plates	3.45c.
Cold-finished bars	3.87c.
Bands and hoops	3.55c.
Hot-rolled annealed sheets, No. 24	3.90c.
Galvanized sheets, No. 24	4.50c.
Cold-rolled sheets, No. 20	4.95c.

On mild steel bars, shapes, plates and hoops and bands the base applies on 400 to 14,999 lb. On cold-finished bars, hot-rolled sheets, galvanized sheets and cold-rolled sheets base applies on 15,000 lb. and over.

BALTIMORE

Base per Lb.

*Mild steel bars	2.95c.
*Iron bars	2.95c.
*Reinforcing bars	2.95c.
*Structural shapes	2.95c.
†Plates	3.00c.
†Hot-rolled sheets, No. 10	3.10c.
‡Hot-rolled annealed sheets, No. 24	3.60c.
‡Galvanized sheets, No. 24	4.30c.
*Bands	3.20c.
*Hoops	3.45c.
§Cold-rolled rounds	3.58c.
§Cold-rolled squares, hex. and flats	3.58c.
Rivets	4.40c.
Bolts and nuts, per cent off list	60 and 10

*Quantity extras per size apply. †Quantity extras per thickness apply. Hot-rolled quantity extras are: 2000 lb. and over, base; 1500 lb. to 1999 lb. add 15c. per 100 lb.; 1000 lb. to 1499 lb., add 30c.; 0 to 999 lb., add 50c.

250 bundles and over, base. For 1 to 9 bundles add 50c. per 100 lb.; for 10 to 49 bundles add 25c.

‡Base for 1000 lb. and over. For 500 to 999 lb. add 25c. per 100 lb.; for 300 to 499 lb. add 75c.; for 0 to 299 lb. add $1.25.

CHATTANOOGA

Base per Lb.

Mild steel bars	3.31c.
Iron bars	3.31c.
Reinforcing bars	3.31c.
Structural shapes	3.56c.
Plates	3.56c.
Hot-rolled sheets, No. 10	3.36c.
Hot-rolled annealed sheets, No. 24	4.21c.
Galvanized sheets, No. 24	4.86c.
Steel bands	3.61c.
Cold-finished bars	3.98c.

MEMPHIS

Base per Lb.

Mild steel bars	3.47c.
Shapes, bar size	3.47c.
Iron bars	3.47c.
Structural shapes	3.67c.
Plates	3.67c.
Hot-rolled sheets, No. 10	3.47c.
Hot-rolled annealed sheets, No. 24	4.27c.
Galvanized sheets, No. 24	4.97c.
Steel bands	3.72c.
Cold-drawn rounds	3.89c.
Cold-drawn flats, squares, hexagons	5.89c.
Structural rivets	4.25c.
Bolts and nuts, per cent off list	65
Small rivets, per cent off list	50

NEW ORLEANS

Base per Lb.

Mild steel bars	3.30c.
Reinforcing bars	3.50c.
Structural shapes	3.55c.
Plates	3.55c.
Hot-rolled sheets, No. 10	3.55c.
Hot-rolled annealed sheets, No. 24	4.50c.
Galvanized sheets, No. 24	4.95c.
Steel bands	3.95c
Cold-finished steel bars	4.15c.
Structural rivets	4.25c.
Boiler rivets	4.25c.
Common wire nails, base per keg	$3.10
Bolts and nuts, per cent off list	70

PACIFIC COAST

	Base per Lb. San Francisco	Los Angeles	Seattle
Plates, tank and U. M.	3.50c.	3.60c.	3.55c.
Shapes, standard	3.50c.	3.60c.	3.55c.
Soft steel bars	3.50c.	3.60c.	3.70c.
Reinforcing bars, f.o.b. cars dock Pacific ports	2.45c.	2.45c.	2.45c.
Hot-rolled annealed sheets (No. 24)	4.25c.	4.35c.	4.40c.
Hot-rolled sheets (No. 10)	3.60c.	3.70c.	3.75c.
Galv. sheets (No. 24)	5.00c.	4.95c.	5.00c.
Cold finished steel Rounds	5.80c.	5.85c.	6.00c.
Squares and hexagons	7.05c.	7.10c.	7.25c.
Flats	7.55c.	7.60c.	8.25c.
Common wire nails —base per keg	$3.20	$3.20	$3.20
less carload			

All items subject to differentials for quantity.

TOOL STEEL

Prices are same for warehouse distribution at all points on or East of Mississippi River. West of Mississippi quotations are 1c. a lb. higher.

Base per Lb.

High speed	57c.
High carbon chrome	37c.
Oil hardening	22c.
Extra	17c.
Regular	14c.

Ingot Output Rises to 61 Per Cent at Cleveland

Sheet Mills At Capacity As Automotive Specifications Increase—Kitchen Utensil Makers Require Heavy Tonnage

CLEVELAND, Oct. 15.—Ingot output rose two points to 61 per cent of capacity in the Cleveland-Lorain territory this week, the increase resulting from the putting on of one additional open-hearth furnace. New business from the automotive industry in sheets, bars and strip steel continues to expand and the miscellaneous demand for finished steel is being well maintained.

Local sheet mills are operating at capacity and strip mill operations are better. Shipments of sheets to the motor car manufacturers have stepped up as mills are now making deliveries of full-finished material ordered a few weeks ago, the processing of which takes some time.

Demand for tin mill black plate for manufacturing kitchen utensils has taken quite a spurt. Consumers of tin plate are inquiring for the tin plate price for next year. This, however, may not be named for several weeks. The advance in the price of tin evidently is causing anxiety among tin plate buyers who would like to get under cover.

With the absence of additional public work projects, activity in the construction field for the present is rather limited. Projects for which WPA funds have so far been allotted in this State do not involve steel tonnages of any size, although grade crossing work in this territory when it finally comes out will require considerable steel. There is an absence at present of new State highway work requiring steel for bridge construction.

Demand from railroads is limited to small lots of steel for repair work. Improvement in car loadings and the better outlook in the railroad field are expected to cause railroads to do an increased amount of car repair work.

Pig Iron

The melt appears to be steadily gaining. This is indicated by an increase of 28 per cent in shipments by a leading Lake furnace this month over the same period in September. Demand from automotive foundries and foundries specializing on motor car business is increasing, as these consumers are stepping up production schedules. While buying has fallen off, there is still a fair volume of new business. There has been additional buying by some of the larger foundries that recently made conservative purchases for the current quarter. Foundries as a rule are carrying small inventories. Shipments continue good to makers of heating equipment, sanitary ware and agricultural implement manufacturers. Operations of jobbing foundries are spotty.

Sheets

The automotive industry continues to place considerable business, although large lot orders from that source have not yet materialized. Demand from the refrigerator, washing machine tubs, stove and barrel industries is fairly active. While some of the mills catering to the automotive field are maintaining good operation schedules, they are unable to accumulate a backlog. Deliveries in some cases have slowed down. One producer cannot make shipments in less than two or three weeks on sheets of grades that are box annealed and are given subsequent finishing operations. The local sheet mills are operating at capacity.

Strip Steel

Some new business in hot and cold-rolled strip came from the General Motors parts plants during the week and orders for substantial tonnages are expected from the same source within a few days. There is a fair miscellaneous demand from manufacturers of shovels and toys and from jobbing stamping plants. The local plant is operating its hot strip mill at 70 per cent of capacity this week and its cold mill at 85 per cent.

Iron Ore

Consumption of Lake Superior ore during September was 2,654,278 tons, a gain of 38,351 tons over August, and compared with 1,236,392 tons in September last year. Furnace stocks Oct. 1 were 28,512,023 tons. Stocks at furnaces and on docks on that date were 33,468,851 tons, or 1,412,027 tons less than on the same date last year. There were 93 furnaces in blast, using Lake ore on Oct. 1, a gain of three for the month.

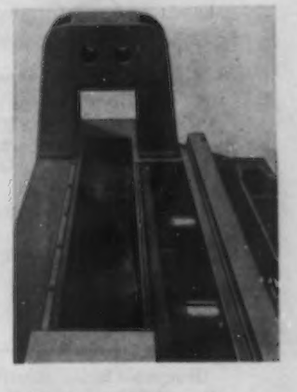
Receipts at Lake Erie ports in September were 3,249,973 tons as compared with 2,343,438 tons during the same period last year. Receipts at these ports until Oct. 1 were 15,255,751 tons as compared with 13,382,639 tons for the corresponding period a year ago. Shipments from Lake Erie ports in Sep-

TRIPLE COMPRESSION

SCRAP BALERS

STYLE
100 TC
(100 x 51 x 36)
and other sizes

Also Regular
Double
Ram Presses
in all sizes



GALLAND-HENNING
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COMPLETE LINE OF BALERS: Electric and Hydraulic, also HYDRAULIC PRESSES AND PUMPS

tember were 1,966,247 tons, a gain of 552,197 tons over the same month last year. Shipments from these ports until Oct. 1 were 11,029,224 tons, a gain of 1,334,716 tons as compared with the corresponding period last year. Receipts at other than Lake Erie ports in September were 1,348,841 tons and for the season until Oct. 1 were 6,125,119 tons as compared with 5,095,444 tons during the same period a year ago. Dock stocks Oct. 1 were 4,956,828 tons, a decrease of 343,997 tons as compared with the same date a year ago.

Bolts, Nuts and Rivets

Demand from the automotive industry has expanded and orders continue in good volume from agricultural implement manufacturers and jobbers. Little business is coming from railroaods. Shipments show an increase over September. The industry is operating at 40 to 45 per cent of capacity. Demand for rivets is still light but shows a slight upward turn. Railroad car repair work is in prospect, which is expected to help the rivet industry.

Bars, Plates and Shapes

With increasing demand from the automotive industry and the volume of miscellaneous business well sustained hot-rolled bars are very active. Stimulated by new orders from motor car plants, alloy bar business shows considerable gain. Business in cold-finished bars also has improved. Structural shapes are moving well in small lots. A gain is in evidence in private construction work involving small tonnages of structural material. General contracts have been let for two local Federal housing projects requiring 2300 tons of reinforcing bars, and bids will be opened Oct. 17 for buildings for the Easterly sewage disposal plant, Cleveland, taking 550 tons of shapes and reinforcing bars.

Scrap

New consumer demand is lacking. While most mills have good stocks some are expected to make additional purchases within a week or two. Prices on steel making grades are untested. Dealers are paying $8 for blast furnace scrap for local delivery. While some scrap is being held for higher prices, plenty is available at current quotations. Cast scrap is in good demand.

Bucyrus-Erie, South Milwaukee, Wis., has commenced shipment to the Bently Coal Co., Clinton, Ind., of disassembled parts of the largest power shovel ever constructed, with a bucket capacity of 30 cu. yd., for stripping purposes in the Indiana coal fields.

Open-Hearth Output Sustained at Buffalo

BUFFALO, Oct. 15.—A fourteenth open-hearth which had been in operation at Bethlehem's Lackawanna plant last week is being repaired, but this unit is needed and operations will probably be restored to fourteen this week. Republic Steel Corpn. and Wickwire-Spencer Corpn. are operating four and two furnaces respectively. Seneca sheet division of Bethlehem is operating at 80 per cent of capacity.

Steel fabricators are keeping busy on small-sized lots. The 100-ton jobs are scarce though many are looming as the result of the PWA program throughout the State. A Buffalo fabricator has the contract for 300 tons of steel plates for a Dunkirk standpipe. Plans are being drawn for a new high-level bridge in Buffalo to be built with the aid of WPA, State highway department and grade-crossing commission funds. This will require 7500 tons of structural steel. Bids for the piers will be taken, probably about the middle of November.

Pig iron business is sustained with a considerable demand for small lots and an important demand for larger tonnage.

Scrap prices are firm despite the lack of sizable buying. Railroad lists brought $14.75, Pittsburgh, for No. 1 steel and a local consumer has paid as high as $13 for a few carloads. Sales of No. 1 machinery cast scrap and railroad malleable have been made at the market. Close of navigation shortly will harden the old material market, according to dealers.

Boston Pig Iron Sales Sustained

BOSTON, Oct. 15.—Pig iron sales are holding up well, having totaled 2500 tons in the past week, mostly for prompt shipment. A few round lots were included in transactions. A textile machinery maker is inquiring for 500 tons of No. 1X iron and there are numerous inquiries for less than 100 tons under negotiation. Business prospects for the current week look good. The New England melt is holding around 40 per cent of rated capacity with indications of increasing.

Scrap exporters are still up in the air regarding the fulfillment of their contracts, due to high insurance rates and unwillingness of steamer owners to make charters. The domestic scrap market is showing a little more life, but is by no means active. Prices on the most active items, notably No. 1 heavy melting steel, turnings, bundled skeleton and machinery cast are easier, which has caused some holders to withdraw offers to sell. Machinery cast appears to be the most active grade, good tonnages being moved to New England points at $9 to $9.50 a ton, delivered. No. 1 steel, turnings and bundled skeleton are moving to the Pittsburgh territory.

The fabricated shape and reinforcing bar business prospects are brighter than for some time due largely to PWA allotments and to some private construction.

Sheet Demand Still Strong at Cincinnati

CINCINNATI, Oct. 15.—Activity in the sheet market continues to be an unusually bright spot in this area. Automotive, household equipment and broad miscellaneous demand are sustaining bookings at the rate of nearly 100 per cent, with rolling schedules up to about 90 per cent of capacity. Price schedules are firmer with relatively no pressure from buyers.

In keeping with the mill activity, ingot production is still at a high rate. Average operation of openhearths, however, dipped four points to 80 per cent with the taking out of one furnace during the week.

The pig iron market is conservatively active, sales for current and immediate future needs having been about 1500 tons. Haste to cover before rumored advances in prices has been halted and the larger consumers are watching developments and refusing to be stampeded into heavier buying. With the exception of the jobbing foundries, the melt is moving upward, average market operations approaching 50 per cent of capacity. Most noticeable is the high melt in automotive and stove foundries, while machine tool interests are operating steadily with prospects good.

Steady industrial ordering sustains warehouse demand at levels slightly in advance of last month. Prices on bars have advanced about $1 a ton.

The scrap market is stronger as dealers hold material for higher prices. Mill disposition to accept substantial commitments is nil, ordering being only for small amounts. A hold-up at one point has been lifted, but shipping schedules have been reduced to prevent crowding of materials.

Cast Iron Pipe

Concord, N. H., will have plans ready about Nov. 1 for an addition to its water distribution system to cost $91,000. PWA grant has been allotted. Metcalf & Eddy, 1300 Statler Building, Boston, are engineers.

Hampden, Me., has preliminary plans for a water system to cost $155,953. PWA grant has been allotted. W. H. Owen, Castine, Me., is engineer.

Emergency Public Works Commission, Rhode Island, has received a $67,800 appropriation from Government for a Wallum Lake sanatorium, Burrillville, R. I., water supply system. O. Perry Sarle, 95 Fountain Street, Providence, R. I., is engineer.

Norwell, Mass., has been allocated $242,000 by PWA for a water system. Action on project will be taken at a town meeting Oct. 21. Whitman & Howard, 89 Broad Street, Boston, are engineers.

West Newbury, Mass., will hold a town meeting Oct. 21 to act on a water system project, for which PWA has allocated $138,000. Whitman & Howard, 89 Broad Street, Boston, are engineers.

Mansfield, Ohio, plans pipe lines for water system. Fund of $45,000 has been approved by PWA for this and other waterworks installation. James F. Carrigan, director, Department of Public Service, in charge.

Glendale, Ariz., plans pipe lines for water supply. Fund of $11,500 has been secured through Federal aid.

Asheboro, N. C., plans 13,000 ft. of 12-in. for main water line, and about 9000 ft. of 6-in. for distributing mains. Fund of $80,000 is being arranged for this and about 19,000 ft. for new sewer lines. E. A. Taplin, High Point, N. C., is consulting engineer.

Essex, Mass., has secured Federal appropriation of $160,000 for pipe lines for water system, elevated steel tank and tower, and other waterworks improvements. Whitman & Howard, 80 Broad Street, Boston, are consulting engineers.

Greenfield, Iowa, asks bids until Oct. 28 for pipe for water supply; also for other waterworks installation, including pumping station, filtration plant and impounding reservoir. Fund of $70,000 has been arranged. Lafe Higgins, Jr., Hubbell Building, Des Moines, Iowa, is consulting engineer.

Dos Palos, Cal., plans pipe line for water system. Fund of $28,300 is being secured through Federal aid to make total appropriation of $63,500 for this and other waterworks installation.

Fornfeldt, Mo., plans about 23,000 ft. of various sizes for water supply; also elevated steel tank and tower and pumping station. Fund of $48,000 is being arranged, John J. Miller, Illmo, Mo., is consulting engineer.

Rushville, N. Y., plans water pipe lines. Fund of $65,000 is being arranged for this and other waterworks installation. W. S. Lozier, Inc., 10 Gibbs Street, Rochester, N. Y., is consulting engineer.

Watsonville, Cal., plans pipe lines for water system. Fund of $41,478 is being secured through Federal aid to make up appropriation of $92,000 for project, including other waterworks installation.

Duck Hill, Miss., plans 11,250 ft. of 2 to 8-in. for water supply; also 50,000-gal. elevated steel tank and pumping station. Fund of $54,500 has been secured through Federal aid for this and sewer system improvements. John M. Gilfillan & Associates, 617 North Tenth Street, Birmingham, are consulting engineers.

Wallace, Kan., plans water pipe lines. Fund of $23,000 is being arranged through Federal aid and bond issue for this and other waterworks installation. Charles W. Suit, Garden City, Kan., is consulting engineer.

Celina, Tenn., will soon takes bids for pipe for water system; also for elevated steel tank and tower, and water pumping station. Cost about $41,500. C. N. Harrub Engineering Co., American National Bank Building, Nashville, Tenn., is consulting engineer.

Dallas, Tex., closes bids Oct. 21 for pipe lines for water supply in Fair Park district. Cost close to $50,000. A. P. Rollins, director, Department of Public Works, in charge.

Torrance, Cal., will open bids Oct. 29 on 600 tons for water system improvements.

Torrey, Utah, has opened bids on 112 tons of 2 to 4-in.

Seattle, opened bids Oct. 17 on 135 tons of 16-in.

St. George, Utah, will open bids Oct. 26 on 11,800 ft. of 3 and 4-in.

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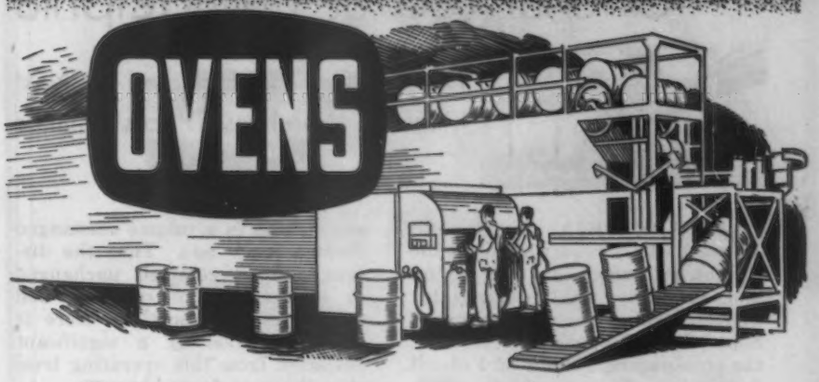

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BARTLETT-SNOW *Paint Booths and Ovens*
BARREL WASHERS—DEDENTERS—TESTERS—CONVEYORS—UP-ENDERS

Detroit Scrap is Holding Steady

DETROIT, Oct. 15.—Scrap prices at Detroit are fairly steady and unchanged. Dealers do not anticipate any material alteration in quotations during the next few weeks. They are delivering tonnages on recent purchases, but report that mills are not interested in making further commitments at this time.

Buying and Steel Operations Unchanged at Philadelphia

Heavier Demand Expected In Next Month — Warehouse Prices Change —Scrap Steady

PHILADELPHIA, Oct. 15—All steel sellers report a halt in the upward trend in steel buying and, generally, total bookings for October are only about on a par with September tonnages. In view of the encouraging volume of Federal financed roads and schools which are scheduled for bidding during the next two months and also in view of the steady demand from autobody plants and miscellaneous sources, there is a definite feeling here that the present lull will be displaced by another spurt in buying before the year's end.

Inasmuch as expected improvement in consumer demands has failed to materialize, district mills have not found it advisable to increase mill operations. Two small plants in this area which had expected to add open-hearths have now delayed this action, and Bethlehem has not found it necessary to add melting units at other district plants while Sparrows Point is operating at capacity. The Coatesville and Harrisburg mills are melting in a volume unchanged from a week ago. Thus the district rate is retained unchanged at 40 per cent of capacity, and from present indications there is little likelihood of a significant deviation from this operating level over the next fortnight.

Readjustments in mill extras and base prices have forced warehouses to likewise revise selling prices. Soft steel bars, iron bars and small shapes are now quoted 10 points higher a pound and No. 24 gage galvanized sheets are also up 10 points to 4.30c. per pound

Of considerable benefit to this area would be the revival of large scale mining in the New Jersey ore fields. Much of this property has been closed down for years, but it is known that the United States Steel Corpn. has been making extensive investigations of ore quality and mine conditions.

Pig Iron

Furnace representatives were looking forward to October sales considerably in excess of September tonnages. However, bookings so far this month have not conformed with expectations. Despite this failure of demand to improve, shipments on old orders this month will equal, or possibly exceed, shipments for any other month this year. New business for the most part is still confined to carlot sales to small users, although some large melters are more willing to purchase for stock as a precautionary measure. There is a growing feeling that first quarter prices may be advanced to offset higher costs of raw products brought about by the recently passed Guffey coal bill and the emergency freight charges which went into effect a number of months ago.

Sheets and Strip

Autobody stamping plants continue to buy in fair volume against estimated fourth quarter requirements. Likewise, radio makers and stove plants are steadily in the market for sheets, and jobbers and warehouses are demanding shipments more frequently. Railroads continue to limit orders to routine repair requirements, and there is little possibility of an early revival of heavy buying for new construction. The State of Maryland has opened bids on 320 tons of 22-gage license stock, but no award has yet been made. In general, the months of August and September were the best this year for new orders, and October business has only so far about equaled that for September. All prices are apparently stable, with little talk of advances for the first quarter and only occasional rumors of price concessions on the part of smaller mills.

Bars, Plates and Shapes

No shape tonnage of over 100 tons was awarded during the week, but the outlook for this grade of steel is more promising as Pennsylvania makes plans to release a large volume of Federal-financed road and school building tonnages. The first structural work of this nature will come out for bidding early in November, and about 350 tons of reinforcing steel was bid on late last week. About 700 tons for the first two WPA schools in Philadelphia is also expected out within the next two weeks. Pending plate tonnages include 60 to 100 mine cars for the Lehigh Coal & Navigation Co. and 15,000 tons for an ocean liner for The International Mercantile Marine.

Scrap

Even though buying in this area has definitely leveled off, the market for steel scrap is just as steady now as during the rise of a month

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FINE TOOL STEELS
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ago. This underlying strength is directly attributed to the slowness with which supplies are coming out at present prices and the modest inventories in the yards of most district mills. In the absence of new sales of No. 1, this grade continues to be quoted at $12, and No. 2 is very firm with brokers paying over $11 for domestic delively and freely offering $10.50, with few takers, for export shipment. Cast grades are now just as strong as are steel grades. Many small district foundries are asking for tonnages of breakable cast at from $11.25 to $11.50, and No. 1 cast can be sold for as high as $13. Stove plate is in steady demand by brokers for delivery to nearby mills, and the Harrisburg consumer is paying at least $9.50 for this grade. The mills at Claymont, Del., and Coatesville, Pa., are still holding up shipments on outstanding No. 1 orders, but the modest tonnages due these consumers will probably be released during the next fortnight. It is quite possible that export demand may be revived to some extent here before the end of the year. Despite excessive insurance and war risks, shipments to Italy are leaving adjacent Atlantic ports and one broker is endeavoring to build up a cargo here. Japanese buying may be revived during the next month, according to the principal Japanese trading house. In Baltimore, Morris Shapiro was awarded the W. B. & A. electric railroad for $252,150. A small portion of this road was resold for continued operation, but the remainder is now being scrapped. Shapiro is also now breaking up 11 navy boats, shipping part of the scrap abroad and selling some to nearby consumers. A total of about 80 boats will be scrapped during the next 18 months.

Imports

The following iron and steel imports were received here last week: 41 tons of steel bars, 29 tons of steel tubes and 23 tons of steel wire from Sweden, and 18 tons of structural shapes from Belgium.

National Steel Corpn. declared an extra dividend of 12½c. a share on common stock, in addition to regular quarterly dividend of 25c. a share, at a meeting of the board of directors at Pittsburgh on Oct. 14. The dividend will be payable Oct. 31 to stockholders of record on Oct. 24.

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SPONGE IRON
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Reinforcing Steel

Awards 3,415 Tons—New Projects 3,200 Tons

AWARDS

New York, 1900 tons, procurement division, Treasury Department, WPA projects, distributed among five bidders.

New York, 165 tons, postoffice in Bronx, to Concrete Steel Co.

Burlington County, N. J., 265 tons, highway, to Igoe Brothers.

Philadelphia, 285 tons, navy yard shipway, to Joseph T. Ryerson & Son, Inc.

Camden, N. J., 250 tons, port commission terminal development, to Concrete Steel Co.

Cleveland, 150 tons, for FERA, to Patterson-Leitch Co.

State of Illinois, 120 tons, road work, to Calumet Steel Co.

Los Angeles, 611 tons, material for Metropolitan Water District, Specification No. 45601, to Concrete Engineering Co.

Los Angeles, 250 tons, building at Jefferson high school, to an unnamed bidder.

State of Oregon, 220 tons, bridges and highway work in six counties, to unnamed bidders.

NEW REINFORCING BAR PROJECTS

Bound Brook, N. J., 150 tons, building for Sherwin-Williams Co.

Providence, R. I., 300 tons, school.

Cleveland, 1100 tons, West Side Federal housing project; Madsen Construction Co., Minneapolis, general contractor.

Cleveland, 1100 tons, Outhwaite Federal housing project; George A. Fuller Co. general contractor.

St. Louis, 350 tons, Southwest high school; Boaz-Kiel Construction Co., St. Louis, general contractor.

Denver, 115 tons, siphon pier on South Boulder diversion conduit; bids rejected and new bids will be opened Oct. 23.

State of Colorado, 100 tons, highway work in four counties; bids Oct. 21.

State of California, 151 tons, highway work in five counties; bids Oct. 30.

Orange County, Cal., 194 tons, State grade separation structure; bids Oct. 31.

Alameda County, Cal., 1100 tons, State undergrade crossing at Peralta Street; J. F. Knapp low bidder on general contract.

Bonneville Dam, Ore., 3400 tons, power house substructure and fishway; General Construction Co. and J. F. Shea Co. low bidders on general contract.

Sources of American Imports of Iron and Manganese Ores

(In Gross Tons)

	August, Iron Ore		Manganese Concentrates, 35 Per Cent or Over	
	1935	1934	1935	1934
Canada	7,204	2,135	....	....
Cuba	11,000	22,000	....	6,077
Chile	66,400	109,000	....	....
Norway	....	....	....	....
Russia	8,300	....	4,587	....
India	....	....	4,907	1,040
Brazil	....	....	....	3,957
West Africa	....	....	3,626	6,394
French Africa	....	....	....	....
Australia	8,655	....	....	....
United Kingdom	....	5	....	....
Other countries	7,129	20,363	617	....
Total	108,688	153,503	13,737	17,468

The Joseph Schonthal Co., Columbus, Ohio, scrap iron dealer, has opened an office at 1331 Union Trust Building, Cleveland, in charge of Manly R. Burgin as manager and Jack Levand as assistant manager.

Demand for Finished Steel Products Steady at New York

Ocean Liner Will Require 15,000 Tons of Plates—Structural Steel and Reinforcing Bar Inquiry Continues Heavy

NEW YORK, Oct. 15.—Sales of finished steel in this district during the first half of October were somewhat heavier than in the corresponding period last month, but volume was behind that recorded in the last half of September. Uncertainty over the international situation may have been partly responsible for the slight recession, but sellers now expect further gains.

Heavy inquiry for structural steel and reinforcing steel dominates the market, but no important lettings have been reported during the last week. Added to the list of pending projects is the New Jersey land section and plaza for the Midtown Tunnel at New York, which will require 1500 tons of shapes and 1500 tons of concrete bars. Alternate bids will be taken Nov. 7 on cast iron and steel linings. At least 25,000 tons of structural steel is involved in large jobs alone which will be placed during the next six weeks.

The International Mercantile Marine-Roosevelt Steamship Co. will soon ask for bids on a liner similar to the *Washington* and the *Manhattan*. About 15,000 tons of shapes will be required. Approximately 3600 tons of plates will be needed for three streamlined ferry boats for the New York Bureau of Plants and Structures which will be built with PWA funds.

Railroad buying continues light and local steel sellers are unable to ascertain the plans of the carriers for the purchase of either rails or rolling stock. It is now believed that repair programs may constitute the bulk of such activity in the East. Most of the roads have large tonnages of rails on their rights of way and plan to make only the most necessary replacements during the fall and winter months.

The New York Central has not yet closed against its fourth quarter inquiry for miscellaneous requirements and one bidder is reported to have omitted the $3 a ton increase on billet prices. The new extras on car axles are also said to be subject to shading and some weakness in plate prices continues. However, the price structure generally seems to be somewhat more steady, and less consumer resistance is encountered.

Pig Iron

Consumer demand eased mildly last week, and approximately 5200 tons was sold, compared with 5600 tons in the previous week. Foundry specifications for immediate shipment on earlier bookings, however, were felt throughout the market, and indicated increased melting operations. Though higher production costs prevail as a result of emergency freight tariffs on raw materials and higher coal prices, no steps have been taken to advance iron quotations. Sellers, however, have not lost interest in the question.

Reinforcing Steel

Building and highway construction remain active in this area, and imposing tonnages continue to flow into consumer channels. Igoe Brothers took 265 tons for a highway in Burlington County, N. Y., and Concrete Steel Co. was awarded 165 tons for a Bronx post office, previously reported as pending. Individual contracts, totaling 1900 tons, were let by the procurement division of the Treasury Department to five different bidders. The Tri-boro authority reported a low of $2,144,830, submitted by the Poirier & McLane Corpn., on the 5750-ton Randall's Junction job. Bids will be taken Nov. 7 on 1500 tons for the New Jersey approach to the Midtown Tunnel, New York.

Scrap

Present prices are not drawing out steel scrap tonnages in any volume, and new export business continues comparatively scarce. Thus this market is somewhat listless, with no immediate prospect of price readjustments or heavier turnovers. One 10,000-ton steamer is loading in nearby Jersey for Italy, despite the abnormal insurance rates now current and the precarious conditions incident to delivering this material. At least two brokers are loading small tonnages for Japan against old contracts, but this country continues to ignore offerings inasmuch as the home steel mills are still operating on reduced schedules. One leading Japanese trading concern is of the opinion, however, that buying will be resumed during the next month. Brokers in this vicinity continue to ship occasional tonnages of scrap to Pittsburgh and No. 1 and No. 2 grades to eastern Pennsylvania mills. In addition, a small lot has been sold to the leading Buffalo mill, and canal shipments on this order will be completed during the next three weeks.

Rail Mill Resumes Rolling in South

BIRMINGHAM, Oct. 15.—The Ensley rail mill of the Tennessee Coal, Iron & Railroad Co. reopened Monday for a run of several days to roll 2000 tons of rail. It will then close down for a week or 10 days and resume on an order for 6000 tons, placed by the Seaboard Air Line. The Ensley blast furnaces and open-hearths will not be fired, and the hot metal will be brought over from the Fairfield works.

Thirteen open-hearths were in production last week and the same number is scheduled for the current week. At Fairfield, the Tennessee company is working eight out of nine and at Alabama City, Gulf States Steel Co. has five out of six in operation.

Steel buying continues at a fair rate and is up to expectations, although not as active as during the two or three weeks just preceding Oct. 1, when the new price basis on sheets and merchant wire products became effective.

Sheet and wire production continue at a high rate and will probably continue for a while to fill the orders placed last month. Heavy products are in better demand as a result of highway and PWA construction projects.

Pig iron buying is also growing stronger, but the pickup is gradual. Some melters are covering for longer periods than formerly and spot orders are more numerous. The lag in the pipe market during the past month has prevented a more marked improvement. Seven blast furnaces are in operation. Woodward Iron Co., which blew in a second furnace on Sept. 30, may bank one within the next week if the Alabama coal strike does not show signs of early settlement.

Alabama coal production is at a

standstill, with a few exceptions, and has been since Sept. 23. Last week a few truck mines signed contracts with the union, with the wage increase, but all other operators are standing firm in their protestation that they cannot pay the increases and continue in business.

Drydocks Will Take 43,120 Tons of Steel

SAN FRANCISCO, Oct. 14.—Two floating drydocks, to be constructed at a cost of $10,000,000 for the Navy Department at Pearl Harbor, T. H., will involve approximately 43,120 tons of steel, according to estimates made by the Buread of Yards and Docks. The larger structure will displace 32,000 tons, have a 175-ft. beam and will be approximately 1000 ft. long. The smaller floating dock will cost $750,000. Due to the fact that the structures cannot be moved through the Panama Canal bids will be received exclusively from Pacific Coast firms.

Attention in southern California is centered on the contract for the 25-mile unit of the Colorado River aqueduct on which bids will be opened Oct. 24. From 16,850 to 22,350 tons of reinforcing bars and 10,632 tons of plates will be involved.

Outstanding among the limited number of lettings during the past week was the award of approximately 1000 tons of plates for a pipe line at Everett, Wash., which went to Puget Sound Machinery Depot. Concrete Engineering Co. was the successful bidder for 611 tons of reinforcing bars for the Metropolitan Water District at Los Angeles. Tunnel ribs, totaling 250 tons of shapes, for the District were placed with Consolidated Steel Corpn. Bids have been opened on the general contracts for a State undergrade crossing at Oakland and sub and superstructures on the Bonneville powerhouse on which 3400 tons of bars and 391 tons of shapes respectively will be required.

Very little new work was listed during the past week although several hundred projects, to be financed largely by Federal funds, are in the immediate offing. Many feel that the situation is comparable to "zero hour" for, if appropriated money is to be used, activity must get under way soon. Mill production and warehouse business is favorable. Japanese exporters have shown no lessening in their demand for scrap.

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Scrap Prices Are Higher at St. Louis

ST. LOUIS, Oct. 14.—An East Side melter bought 3000 to 4000 tons of heavy melting steel from several sources during the week for delivery within the next 30 days. This caused dealers to advance the prices of No. 2 heavy melting, miscellaneous standard section rails and rails for rolling 50c. a ton. Foundry grades are in good demand. The Missouri-Pacific sold 60 carloads of scrap on Saturday, and the Louisville & Nashville list of 21,000 tons, closing this week, is expected to go to Eastern markets.

The pig iron trade is experiencing its first speculative buying in a long time, some melters buying for shipment during the first two months of 1936 at present levels. Buying generally has subsided somewhat following the heavy ordering that has prevailed for weeks. Shipments continue heavy, and the October movement is likely to exceed September's.

The market for finished iron and steel is more quiet than it has been, following a period of active buying. Movement of roofing is a bit better. Wire products are moving slowly. Demand for enameling sheets from the stove trade is a bright spot. Boaz-Kiel Construction Co. has been awarded the general contract for the Southwest High School, St. Louis, requiring 350 tons of reinforcing bars and 125 tons of structural steel.

Railroad Equipment

United Carbon Co. has placed order with American Car & Foundry Co. for 10 40-ton hopper cars.

Canadian National has ordered roller bearings from SKF Industries, Inc., for all engine, trailing, and tender trucks of its 10 locomotives, recently purchased.

Timken Roller Bearing Co., Canton, Ohio, will furnish 300 sets of bearings for gear drives of 25 articulated, five car train units now being built for New York Rapid Transit Co. General Electric car drives, using 180 sets of Timken Bearings, will be installed in 15 train units to be built by Pullman-Standard Car Mfg. Co., and 120 sets of Timken bearings will be required in Westinghouse-Nuttall gear drives to be installed in 10 trains now under construction by St. Louis Car Co.

American Car & Foundry Motors Co. has recently received the following orders: Memphis Street Railway, 10 H-12-S coaches; Fitchburg & Leominster Street Railway, one H-15-S coach and one H-17-S coach; Worcester Street Railway, two H-9-S coaches; Reading Transit Co., one H-15-S coach; Syracuse Co-Ordinated Bus Line, Inc., three H-12-S coaches.

Scarcity of Spot Tin Forces Prices To Highest Level of Year

Buying of Copper Declines Following Heavy Coverage for Fourth Quarter —Lead Prices Decline 10 Points, While Spelter Remains Firm

NEW YORK, Oct. 15.—The market has quieted down considerably since higher prices went into effect, but the new level of 9.25c. a lb., apparently is well sustained. Yesterday's sales of 250 tons brought total bookings for the month to date to 61,000 tons. In London, an easier condition prevails, and prices have declined accordingly. Statistics released by the Copper Institute show that during September world stocks were reduced by 18,208 tons, thus bringing the level down to 531,622 tons. Domestic stocks at the end of the month were 241,340 tons. Total world September production was 121,422 tons, and total shipments 133,655 tons. Current business is now entirely confined to January, as fourth quarter requirements have all been covered. In London this morning electrolytic prices varied between 8.75c. a lb. and 8.80c. a lb.

Tin

Since the middle of last week very active conditions have prevailed, and consumer interest in spot and nearby positions has relegated futures to comparative neglect. Acute scarcity of supply characterizes both the domestic and foreign markets. Present domestic stocks of 375 tons indicate some improvement in this respect since last reported, but are notably insufficient to satisfy demand. Arrivals have been sold out ahead of time on the basis of October and November positions. Prices, reflective of the situation, climbed to 54.00c. a lb. for spot Straits metal here yesterday, but today offerings are at 53.00c. a lb. In London this morning standard metal was quoted at £242 for spot, and £225 15s. for futures. The Eastern price was £232 10s.

Lead

Prices were reduced $2 a ton Oct. 10 on the initiative of the leading smelter interest. It is believed all sellers were not participating equally in the market at the higher price level. In one quarter, however, this recent price fluctuation has had no effect whatsoever, and daily intake has been regularly disposed of. A feature of last week's business was that on certain days contracting was almost entirely for October requirements despite earlier buying for this month's needs. November is estimated to be approximately 60 per cent covered. Prices hold at 4.35c. a lb., St. Louis, and 4.50c. a lb., New York.

Zinc

Liquidation of stocks is going on in a very orderly manner, and the statistical position of spelter is very satisfactory. Sales last week totaled 18,000 tons, the bulk of which business was done before prices advanced. Undelivered bookings now total 60,000 tons. October is entirely covered, and November and December are well represented on sellers' books. In addition, considerable buying has been for the forward quarter. During September zinc shipments of 42,219 tons, as against 36,088 tons produced, diminished stocks by 6129 tons. At the end of the month stocks totaled 106,316 tons, an amount sufficient for approximately two and a half months' requirements at the present rate of consumption. Prices continue firm at 4.85c. a lb., East St. Louis, and 5.22½c. a lb., New York.

Ingot Brass and Bronze

The Non-Ferrous Ingot Metal Institute reports that in the 28 days ended Oct. 4, the average prices per pound paid for commercial 80-10-10 and commercial 85-5-5-5 brass ingots were 10.132c. and 8.677c. respectively. In the period ended Sept. 6, the corresponding figures were 9.375c. and 7.925c.

The third annual industrial materials' exhibit will be held in the Hotel Astor, New York, Oct. 21 to 25.

The Week's Prices. Cents Per Pound for Early Delivery

	Oct. 9	Oct. 10	Oct. 11	Oct. 12	Oct. 14	Oct. 15
Electrolytic copper, N. Y.*	9.00	9.00	9.00	9.00	9 00	9.00
Lake copper, N. Y.	9.37½	9.37½	9.37½	9.37½	9.37½	9.37½
Straits tin, spot, New York	51.25	52.12½	53.00	....	54.00	53.00
Zinc, East St. Louis	4.85	4.85	4.85	4.85	4.85	4.85
Zinc, New York†	5.22½	5.22½	5.22½	5.22½	5.22½	5.22½
Lead, St. Louis	4.45	4.35	4.35	4.35	4.35	4.35
Lead, New York	4.60	4.50	4.50	4.50	4.50	4.50

*Refinery quotations; price ¼c. higher delivered in Connecticut.
†Includes emergency freight charge.

Aluminum, virgin 99 per cent plus, 19.25c. a lb., delivered.
Aluminum, No. 12 remelt, No. 2 standard, in carloads, 16.50c. a lb., delivered.
Nickel, electrolytic, 35c. to 36c. a lb. base refinery, in lots of 2 tons or more.
Antimony, Asiatic, 15.75c. a lb., New York.
Quicksilver, $69.50 to $71.50 per flask.
Brass ingots, commercial 85-5-5-5, 9.00c. a lb., delivered; in Middle West ¼c. a lb. is added on orders for less than 40,000 lb.

From New York Warehouse

Delivered Prices, Base per Lb.

Tin, Straits pig	54.00c. to 55.00c.
Tin, bar	56.00c. to 57.00c.
Copper, Lake	10.25c. to 11.25c.
Copper, electrolytic	10.25c. to 11.25c.
Copper, castings	10.00c. to 11.00c.
*Copper sheets, hot-rolled	16.25c.
*High brass sheets	14.62½c.
*Seamless brass tubes	16.62½c.
*Seamless copper tubes	16.75c.
*Brass rods	13.12½c.
Zinc, slabs	5.75c. to 6.75c.
Zinc, sheets (No. 9), casks, 1200 lb. and over	10.25c.
Lead, American pig	5.00c. to 6.00c.
Lead, bar	6.00c. to 7.00c.
Lead, sheets	8.25c.
Antimony, Asiatic	17.00c. to 18.00c.
Alum., virgin, 99 per cent, plus	23.30c.
Alum., No. 1 for remelting, 98 to 99 per cent	18.50c. to 20.00c.
Solder, ½ and ½	31.00c. to 32.50c.
Babbitt metal, commercial grades	25.00c. to 60.00c.

*These prices are also for delivery from Chicago and Cleveland warehouses.

From Cleveland Warehouse

Delivered Prices per Lb.

Tin, Straits pig	58.25c.
Tin, bar	60.25c.
Copper, Lake	10.25c.
Copper, electrolytic	10.25c.
Copper, castings	10.00c.
Zinc, slabs	6.25c. to 6.50c.
Lead, American pig	5.20c. to 6.50c.
Lead, bar	8.50c.
Antimony, Asiatic	17.00c.
Babbitt metal, medium grade	19.25c.
Babbitt metal, high grade	62.25c.
Solder, ½ and ½	33.25c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	6.87½c.	7.62½c.
Copper, hvy. and wire	6.75c.	7.25c.
Copper, light and bottoms	5.75c.	6.25c.
Brass, heavy	3.87½c.	4.50c.
Brass, light	3.12½c.	3.87½c.
Hvy. machine composition	5.87½c.	6.37½c.
No. 1 yel. brass turnings	5.00c.	5.50c.
No. 1 red brass or compos. turnings	5.50c.	6.00c.
Lead, heavy	3.50c.	3.87½c.
Zinc	2.50c.	2.87½c.
Cast aluminum	12.12½c.	13.25c.
Sheet aluminum	13.25c.	14.75c.

Republic Elects New Directors

FOUR new directors were added to the board, two officers were elected and the time limit for the exchange of Truscon Steel stock for Republic stock was extended at a meeting of the directors of the Republic Steel Corpn., Oct. 11. The new directors are: Oscar L. Cox, liquidator, Union Trust Co., Cleveland; Donald B. Gillies, former president, Corrigan, McKinney Steel Co.; Harvey H. Brown, Jr., of Harvey H. Brown & Co., and H. K. Bourne, vice-president, Oglebay, Norton Co., Cleveland. Announcement that the men named would be added to the Republic board when the Corrigan, McKinney merger with Republic was ratified was previously made. Donald B. Gillies was elected vice-president and Edward G. Resch, formerly secretary and treasurer of Corrigan, McKinney Steel Co., was elected assistant treasurer of Republic.

In a letter sent by Republic to Truscon stockholders several weeks ago offering to exchange Republic for Truscon stock, Oct. 10 was set as the expiration date of the offer. At the directors' meeting this date was advanced to Oct. 21. Approximately 63 per cent of both preferred and common stock of Truscon has already been presented for exchange, according to the announcement of R. J. Wysor, executive vice-president of Republic.

Pipe Lines

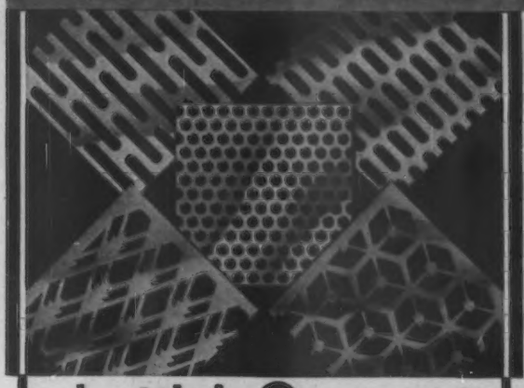
Consumers Power Co., Jackson, Mich., plans new welded steel pipe line from natural gas fields in Millbrook Township, Mecosta County, Mich., to Lansing, Mich., about 60 miles, for gas supply at last noted place and other municipalties in that section, including Eaton Rapids, Grand Ledge, Brighton, Portland and Lake Chemung, to which points branch steel pipe lines will be built. Cost about $400,000.

Abilene, Tex., plans steel pipe lines for natural gas distribution throughout city, including main welded steel trunk pipe line. Cost $1,250,000. Financing is being arranged through Federal aid. J. E. Ward, Harvey-Snider Building, Wichita Falls, Tex., is consulting engineer.

F. P. Gates, Jackson, Miss., engineer, representing company whose name is temporarily withheld, has plans for new welded steel pipe line from point near Jackson to Philadelphia, Miss., for natural gas supply at that place, as well as at Decatur, Union, Pelahatchie and other municipalties in vicinity, where branch 6-in. welded pipe lines will be built. Cost about $850,000. Same interests also propose welded steel pipe line from Jackson to Oxford, Miss., for natural gas supply, with branch lines to Grenada, Lexington, Greenwood, Yazoo City, Coffeeville and other points in district. Cost about $2,000,000.

Hutchinson, Kan., plans steel pipe line for natural gas distribution throughout city, including trunk main for bulk supply. Fund of $564,000 is being secured through Federal aid. H. P. Hertz is city engineer, in charge.

PERFORATED METALS



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Wyoga Gas & Oil Corpn., Room 308, First National Bank Building, Williamsport, Pa., plans 6, 8 and 10-in. welded steel pipe lines in connection with development of natural gas properties near Wellsville, N. Y. A number of wells will be drilled. G. H. Schrack is company engineer.

Lubbock, Tex., has voted bonds for $1,200,000 at special election for steel pipe line system for natural gas distribution, including welded steel trunk line, distributing station and operating equipment.

Union Gas Co., Ltd., Chatham, Ont., plans steel pipe lines for gas distribution at Strathroy, Ont., where franchise is being secured, including trunk main. Project will be carried out early in 1936.

St. George, Utah, will open bids Oct. 26 on 11.5 miles of 12, 14 and 16-in. welded pipe.

OBITUARY

J. S. GILLESPIE, president, American Hollow Boring Co., Erie, Pa., died at the Lakeside Hospital, Cleveland, on Oct. 8, after an operation. He had been head of the company since its organization in 1918.

❖ ❖ ❖

CARL R. GIER of the C. R. Gier Co., New York, died suddenly at his home in New York on Oct. 8, aged 59 years. He was long prominently active in narrow gage railroad activities throughout the country.

❖ ❖ ❖

GEORGE L. WHITE, formerly purchasing agent for the Packard Motor Car Co. and later director of purchases for the Briggs Mfg. Co., died in Harper Hospital, Detroit, on Oct. 11, after a long illness. For the last several years he had been a partner in the LeClair & White Co., men's apparel shop in Detroit.

❖ ❖ ❖

IGNATZ BENESCH, pioneer in the wholesale scrap metal trade of the Central West, died at his home in Milwaukee on Oct. 6, aged 67 years. He had been ill only three days. He was the founder and president of the Benesch Iron & Steel Co. nearly 50 years ago.

❖ ❖ ❖

E. HOMER FAHRNEY, founder and president of the Universal Foundry Co. and the Universal Motor Co., marine engines, Oshkosh, Wis., died of heart disease at his country estate near Oshkosh on Oct. 7, aged 59 years.

❖ ❖ ❖

JOHN H. FLUEGGER, president-treasurer of the Western Blow Pipe & Sheet Metal Co., with which he had been connected for 29 years, died suddenly in St. Louis recently. Born in Germany 71 years ago, Mr. Fluegger came to America when 17 years old, residing first in Cincinnati and going to St. Louis in 1906 to join the Western company. He was made secretary in 1912 and president-treasurer in 1929.

Manufacture and Finish of Golf Club Shafts

(CONTINUED FROM PAGE 34-B)

company guarantees that True Temper shafts shall not break in service. Sample shafts from each 100 are given a Vickers hardness test, and each and every shaft is put in a special jig and checked for deflection. In this test the butt of the shaft is set vertically in a socket at floor level and vertical pressure applied sufficient to cause the shaft to bow 4 in. Next the butt of the shaft is clamped and the shaft bent over a block to check the hardness of the tips, and similarly the butts are tested in the same manner. Following these tests the butts are rung on a plate to check soundness, followed by a final measured deflection test, in which the butt is clamped to a scale and load applied at the tip sufficient to show a 100-lb. reaction on the scale. After passing these tests and before going to the plating and finishing departments, every piece is given a steam test for checks or cracks.

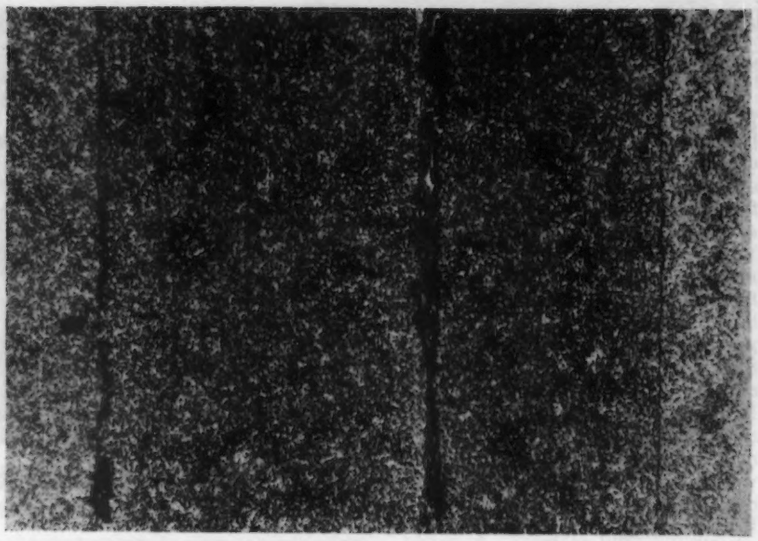

FIG. 4—Photomicrograph of tip and butt of fine temper golf shaft.

Special care is exercised in plating, each piece being lightly ground before the first or copper coating is applied. After copper plating finishing practice varies. Many orders call for full chrome plate, which involves a nickle coat before the chrome is applied. Others require a lacquer finish, and other customers want a pyratone sheath, which is available in a wide range of colors and finishes. Regardless of the type of finish decired, the shafts are inspected before and after every operation. The final inspection is weighing on a specially designed scale which works in connection with a photoelectric cell. A finger on the scale beam moves across the light path, breaking the circuit when the shaft is exactly the right weight, but al-

FIG. 3—On leaving the stepping press all shafts advance to the tempering furnaces.

lowing it to stay open when the shaft is either light or heavy, a tolerance of 3/32 oz. being allowed. On passing this final inspection the shafts move forward to the shipping department, from which they formerly went all over the world. True Temper shafts for China and Japan, Australia, India, South Africa and South America as well as from most of the European countries, are now all shipped from the company's English connections, as the duties are against America. Well over seven million steel shafts have been shipped from the Geneva plant of the American Fork & Hoe Co., and if laid end to end would reach nearly 5000 miles.

Special research on shaft design is continually being conducted in a special laboratory, and production control tests are made at regular intervals. The equipment is practically all specially designed or modified to meet the peculiar needs of the product, the Charpy impact test, for example, being made on a full section of tube instead of a test piece. The permanent set and deflection tests enable detailed information to be developed as to how step length, diameter, etc., affect flexibility, and make it possible to duplicate special orders with a minimum of difficulty. The factory also maintains a well-equipped chemical laboratory with the latest micro-photo apparatus. (Fig. 4.)

Specially designed machinery, accurate control to precision limits in production, and rigid inspection at every step has built a world-wide reputation for the company and its products. Constant physical and metallurgical research and control, coupled with a willingness to install production equipment of the most advanced design can be depended upon to maintain this position.

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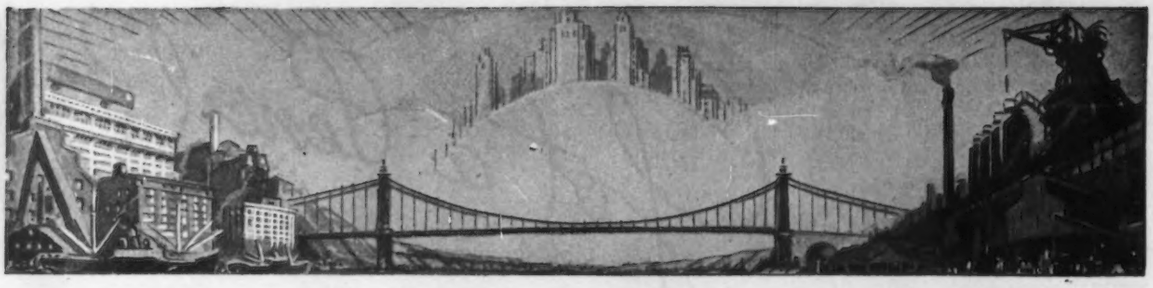
ROXALIN Flexible FINISHES

CELLULOSE & SYNTHETIC TYPES ENGINEERED FOR SPECIFIC PERFORMANCE

Identification of Lindbergh Ladder Nails

(CONTINUED FROM PAGE 22)

jealously protected the results of these findings, awaiting the propitious moment, is illustrated by the guarded references necessary at the time the writer was prematurely called to the stand in order to facilitate the ladder's admission as evidence without disclosing at that time the nature of this nail evidence. The sudden and unexpected collapse of the defense alibi testimony so influenced the subsequent course of the State's presentation of this evidence, which was being withheld as the final surprise blow, as to involve its final omission altogether, in the interests of a prompt verdict favorable to the State in a quick closing. Its disclosure now is with the consent of Attorney General Wilentz, and with the desire on the writer's part, to complete the reported references thereto, in the published and broadcast statements generally made at the time.



Plant Expansion and Equipment Buying

Machine Tool Orders Down In Post-Show Reaction

THERE has been a natural reaction in machine tool orders, so that at present the market is without definite trend. This has been due to two causes; first, the tremendous acceleration in pace that has occurred during the past six months, and second, the exposition itself. Machine tool buyers are now in the position of the boy who is shown a box of attractive assorted candies and is told to make a choice.

There has been a fair volume of sales in single machines during the past week, and small tools are active. Overseas demand has abated, due probably to political uncertainties.

NORTH ATLANTIC

Fisher Body Division, General Motors Corpn., Detroit, has let general contract to White Construction Co., 95 Madison Avenue, New York, for two one-story additions to branch plant at Tarrytown, N. Y., for body manufacture for Chevrolet Motor Co., with works on adjoining site. Cost over $600,000 with equipment. Chevrolet company is also expanding Tarrytown Works, to cost about $500,000.

American Cyanamid Co., 30 Rockfeller Plaza, New York, manufacturer of industrial chemicals, etc., has purchased former silk mill of H. E. Verran Co., Stamford, Conn., comprising five-story building, totaling about 260,000 sq. ft. floor space, on 12-acre tract, and will improve for new branch plant at cost exceeding $100,000. Extensive laboratory facilities will be installed.

Sterling Strip Steel Corpn., 85 Walker Street, New York, has leased portion of building at 292-300 Meserole Street, Brooklyn, for new storage and distributing plant for metropolitan area.

Board of Trustees, Ocean Beach, L. I., asks bids until Oct. 21 for new municipal electric power plant, including two 115-hp. Diesel engines direct-connected to two electric alternators, pumping machinery and auxiliaries, air compressors, switchboard, transformers and accessories, underground electrical distribution system; also for street-lighting system, including lighting standards, etc. Plans and specifications at office of LeRoy B. Iserman, 52 Wall Street, New York.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 22 for one motor-driven punch and shear (Schedule 6209), 20,000 jack-knives (Schedule 6216), for Brooklyn Navy Yard; two 6000-lb. nitric acid retorts, catenary type (Schedule 6131), for White Plains, N. Y.; until Oct. 25, electrically-operated valves, complete with spare parts (Schedule 6161), for Brooklyn and Philadelphia yards; two winches for boat and airplane handling, with spare parts (Schedule 6163), for Brooklyn and Charleston yards; until Oct. 26, 56 davits, complete with pedestal, sheath screw, etc., and two cranks and spare sheath screws (Schedule 6162), for Brooklyn, Philadelphia and Charleston yards.

Pan-American Petroleum & Transport Co., 122 East Forty-second Street, New York, is awarding contracts for equipment for addition to oil refinery at Texas City, Tex., including primary refinery apparatus to Foster-Wheeler Corpn., 165 Broadway, New York. Project will comprise several units to double present output, including expansion in storage and distributing division. Cost close to $1,500,000 with machinery.

Department of Hospitals, Municipal Building, New York, has filed plans for new two-story mechanical laundry plant, 133 x 144 ft., on Rockaway Beach Boulevard, Rockaway Beach, Queens. Cost $475,000 with machinery, conveying and other equipment. Mitchell Bernstein, 2 Columbus Circle, New York, is architect.

New York Shipbuilding Corpn., Camden, N. J., is considering rebuilding storage and distributing warehouse at local shipyard, recently destroyed by fire. Loss close to $200,000 with equipment.

State Purchase Commissioner, State House, Trenton, N. J., asks bids until Oct. 21 for air compressor equipment, water pipe, steel reinforcing bars and other equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 22 for rough machined forgings, turret rollers (Schedule 6180), 1250 aircraft thermometers (Schedule 6119), for Philadelphia Navy Yard.

John Hohen-Adel Brewery, Thirty-fifth Street and Queen Lane, Philadelphia, has let geneoal contract to William F. Koelle & Co., Inc., 1633 Race Street, for one-story addition. Cost close to $25,000 with equipment.

Board of Education, Norristown, Pa., plans manual training department in new three-story high school. Cost about $1,000,000. Davis & Dunlap, 1805 Walnut Street, Philadelphia, are architects.

NEW ENGLAND

Wallace Barnes Co., Main Street, Bristol, Conn., manufacturer of steel springs and allied products, has let general contract to George J. Lacourse, Bristol, for one-story addition to Forestville Division plant. Cost over $50,000 with equipment.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 22 for one motor-driven surface grinder for Newport, R. I., Naval Station (Schedule 6213).

School Board, 3 Bank Row, Greenfield, Mass., plans manual training department in new three-story junior high school at Shattuck Park. Cost $375,000. Financing has been arranged through Federal aid. Bernard Dirks, 278 Main Street, is architect.

Hull Brewing Co., West Street, New Haven, Conn., has plans for two-story addition, 70 x 110 ft. Cost over $60,000 with equipment. A. M. Thomas and Harold Davis, New Haven, are consulting engineers.

McKesson & Robbins, Inc., Fairfield, Conn., manufacturer of drugs and chemicals, has let general contract to Caldwell-Wingate Co., 101 Park Avenue, New York, for three-story addition, 100 x 200 ft. Cost over $75,000 with equipment. Albert Kahn, Inc., New Center Building, Detroit, Mich., is architect and engineer.

Fitchburg Grinding Machine Corpn., Fitchburg, Mass., has been organized by Ralph W. Robbins and Everett H. Dudley, 401 Main Street, treasurer, to manufacture grinding machines and parts.

Metropolitan Coal Co., 20 Exchange Place, Boston, will take bids at once for addition to storage and distributing plant at Chelsea. Cost about $175,000 with conveying, loading and other equipment.

SOUTH ATLANTIC

Carolina Power & Light Co., Raleigh, N. C., plans extensions in transmission lines from Mullins to Aynor, N. C., about 17 miles, including power substation facilities. Cost over $45,000 with equipment.

City Council, Fort Pierce, Fla., plans extensions and improvements in municipal electric light and power plant, including new 2500-kw. turbo-generator unit and accessories, boilers, pumps, fuel oil tanks and other equipment. Fund of $212,700 has been secured through Federal aid.

Atlanta Gas Light Co., Atlanta, Ga., plans extensions and improvements in artificial gas plants and system, including new equipment. Cost over $300,000. Company is disposing of bond issue for $5,000,000 from which fund will be secured.

City Council, DeLand, Fla., has secured fund of $440,000 through Federal aid for new municipal electric light and power

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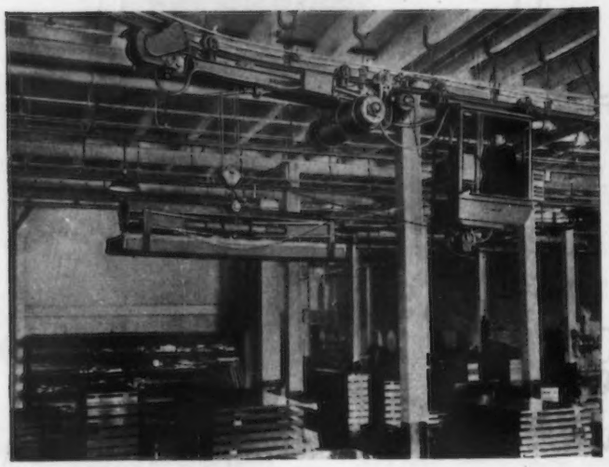

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WICKLIFFE OHIO

plant, and electrical distribution lines for street-lighting and other service. It is proposed to begin work soon.

BUFFALO DISTRICT

Eastman Kodak Co., Rochester, N. Y., plans multi-story addition. Cost about $400,000 with equipment. Completion scheduled early next year.

Trico Products Corpn., 817 Washington Street, Buffalo, manufacturer of automobile equipment and accessories, has let general contract to Crooker, Carpenter & Skaer, Inc., 120 Hardwood Place, for two-story addition, 50 x 100 ft. Cost about $50,000 with equipment. W. R. Jewel, 33 Frontenac Avenue, is engineer.

American Fork & Hoe Co., Dunkirk, N. Y., plans one-story addition to increase present capacity by at least 50 per cent. Cost over $100,000 with equipment. Headquarters are in Keith Building, Cleveland.

Board of Education, Binghamton, N. Y., plans manual training department in new three-story school on Upper Court Street. Cost about $900,000 with equipment. L. J. Kaley, 67 Rotary Avenue, is architect.

WESTERN PA. DIST.

Pittsburgh Plate Glass Co., Grant Building, Pittsburgh, Paint Division, has plans for new one and multi-story paint and varnish plant at Newark, N. J. Cost about $175,000 with equipment. United Engineers & Constructors, Inc., 1401 Arch Street, Philadelphia, is architect and engineer.

Hurley Machine Co., 926 Penn Way, Pittsburgh, has leased floor in Ewart Building, Liberty Avenue and Garrison Way, for local plant.

Lillybrook Coal Co., Lego, W. Va., T. H. Wickham, president, is planning early operation of coal-mining properties in Winding Gulf district, Raleigh County, where 7000 acre tract has been selected. New coal-mining plant will be installed for capacity of about 2000 tons a day, including steel tipple, with washing, screening and sorting divisions, and storage and distributing facilities. Cost over $50,000 with machinery.

United States Engineer Office, Pittsburgh, asks bids until Oct. 26 for four steel dump scows (Circular 77). (Postponed from Oct. 12.)

United States Engineer Office, Huntington, W. Va., asks bids until Oct. 25 for two 15-ton capacity whirler-derrick boats.

OHIO AND INDIANA

Greaves Machine Tool Co., Eastern Avenue and Hazen Street, Cleveland, manufacturer of machine tools and parts, has let general contract to Austin Co., for new one-story machine shop, 70 x 100 ft., part of unit to be used for storage and distribution. Cost close to $30,000 with equipment.

Lorain Castings Co., Lorain, Ohio, has plans for new one-story foundry, 55 x 65 ft., to replace unit recently destroyed by fire. Cost over $40,000 with equipment. Company is a subsidiary of Thew Shovel Co., Lorain.

Triplex Screw Co., 5317 Grant Avenue, Cleveland, manufacturer of cap screws, bolts, nuts, studs, etc., has asked bids on general contract for one-story addition for storage and distribution. Cost about $35,000 with equipment. A. E. Rowe, 13505 Garden Avenue, is engineer.

Progress Vacuum Cleaner Corpn., Cleveland, recently organized, has leased space in former plant of American Multigraph Co., East Fortieth Street and Kelley Avenue, for parts production and assembling. Company plans early expansion in vacuum cleaner line to include other electrical household products.

Contracting Officer, Material Division, Air Corps, Wright Field, Dayton, Ohio, asks bids until Oct. 21 for one blast cleaning room and dust collector equipment (Circular 260); until Oct. 22, 6000 lamp socket sleeves and 6000 lamp socket assemblies (Circular 258); until Oct. 23, panel assemblies (Circular 227), 31 4-wheel trailers (Circular 252); until Oct. 24, two-ring shroud assemblies (Circular

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265), electric battery assemblies, dry and charged (Circular 236); until Oct. 25, 158 3-ton lever ratchet jacks with foot lift (Circular 260); until Oct. 22, 6000 lamp motors and one frequency converter (Circular 259), seven metal spray guns (Circular 273).

Scientific Oil Corpn., Indianapolis, recently organized by Otto B. Heppner, 2526½ North New Jersey Avenue, and associates, has taken over property at West Sixteenth Street and Big Four Railroad lines, as site for new oil refinery for production of lubricating and other oils, with storage and distribution facilities. Cost close to $70,000 with equipment. Mr. Heppner will be president of company, and E. K. Rahke, treasurer.

SOUTHWEST

Modern Engineering Co., 3411 Pine Street, St. Louis, manufacturer of beverage dispensing equipment, has leased space in building at 17 Jarvis Street, Toronto, Ont., for branch plant. Subsidiary has been organized under name of Modern Engineering Co., Ltd., to operate plant. Frank B. Tanner heads new organization.

Thompson-Hayward Chemical Co., 2915 Southwest Boulevard, Kansas City, Mo., has plans for one-story addition, 60 x 120 ft. Cost over $50,000 with equipment. Richard N. Wakefield, Orear-Leslie Building, is architect.

Laclede Gas Light Co., 1017 Olive Street, St. Louis, has let general contract to Gamble Construction Co., 620 Chestnut Street, for one-story equipment service and repair building, with meter division and other mechanical departments. Cost close to $100,000 with equipment. Mauran, Russell & Crowell, Chemical Building, are architects.

City Council, Seneca, Kan., plans new municipal electric light and power plant, and electrical distribution system. Fund of $83,600 is being secured through Federal aid. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

Stenzel Pattern Works, Inc., 2300 Mance Street, Houston, Tex., manufacturer of metal patterns, dies, etc., has plans for new one-story plant, 60 x 75 ft. Cost close to $30,000 with equipment. E. H. Stubee, 3908 Main Street, is architect.

Common Council, Seadrift, Tex., asks bids until Oct. 31 for pumping machinery and auxiliaries, two elevated steel tanks and towers, pipe lines, etc., for municipal waterworks. H. R. F. Helland, Frost National Bank Building, San Antonio, Tex., is consulting engineer.

Apex Construction Co., Second National Bank Building, Houston, Tex., pipe line contractor, has acquired about six acres on Humble Highway, near city limits, and will use part of site for new one-story equipment storage and service building, including repair and reconditioning department. Cost about $25,000 with equipment.

MICHIGAN DISTRICT

Kalamazoo Stove Co., Kalamazoo, Mich., has let general contract to O. F. Miller Co., Kalamazoo, for one-story addition, 72 x 260 ft. Cost over $65,000 with equipment.

Chevrolet Commercial Body Division, General Motors Corpn., Detroit, and 1100 West Henry Street, Indianapolis, has asked bids on general contract for two one-story additions to plant at last noted place, 322 x 720 ft., and 402 x 600 ft. respectively. A power house will also be built. Cost about $850,000 with equipment. Albert Kahn, Inc., Detroit, is architect and engineer.

Dailey Brewing Co., Flint, Mich., has been purchased at a receiver's sale by Kurt Kling, 1501 National Bank Building, Detroit, and associates, who will take over plant at once and expand to increase capacity from 150,000 to 250,000 bbl. per year. Cost close to $100,000 with equipment. New company will be organized to operate plant.

Shatterproof Glass Co., 151 South Waterman Avenue, Detroit, plans rebuilding part of plant recently destroyed by fire. Loss close to $200,000 with equipment.

WASHINGTON DIST.

Gray Concrete Pipe Co., Edison Highway and Duncan Lane, Baltimore, has plans for group of five one-story units, 60 x 120 ft. Cost over $35,000 with equipment. Porter T. Bond is company architect.

Bureau of Yards and Docks, Navy Department, Washington, asks bids until Oct. 23 for new shop buildings at Navy Yard, Charleston, S. C. (Specification 7989); until Nov. 6 for new equipment warehouse, garage and service building at Naval Station, Pearl Harbor, T. H. (Specification 8003).

Purchasing Officer, Department of Interior, Washington, asks bids until Oct. 21 for two rock and gravel crushing plants (Proposal 1020); until Oct. 22, 3000 metal signs for Chicago (Proposal 1027).

Chesapeake & Ohio Railroad Co., Richmond, Va., plans addition to engine house with shop facilities at Charlottesville, Va. Cost over $75,000 with equipment. C. W. Johns is company engineer in charge.

Superintendent of Lighthouses, Norfolk, Va., asks bids until Oct. 21 for Diesel engine-driven electric generating plants.

General Purchasing Officer, Panama Canal, Washington, asks bids until Oct. 28 for one 30-ton electric traveling crane; also for 26 pairs of swing steel doors and 72 single swing steel doors (Schedule 3097).

Director of Public Works, Norfolk, Va., asks bids until Oct. 25 for three automatic pumping stations in connection with sanitary sewer installation in Willoughby, East Ocean View and East Bramleton districts.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 22 for 12 aluminum alloy aircraft propeller blades for Hampton (Schedule

THE "SHOTGUN WEDDING" OF RUBBER AND STEEL

FOR YEARS industry tried to make rubber stick to steel. Then Goodrich developed the Vulcalock process which joins the two in an inseparable bond—and a hundred industrial improvements were made possible.

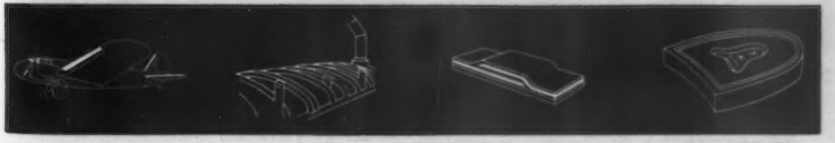
—Now steel tanks can be lined with soft and hard rubber in layers—and steel plant pickling costs are reduced, acid storage is revolutionized.

—Metal chutes handling rock are covered with rubber which does not tear off—and life of the chutes is increased ten times.

—Vibration dampeners mounted in shear are developed—and a new era in automobile comfort is launched.

—Giant ball mills, marine bearings are both lined with rubber by the new process—and maintenance costs tumble.

The Vulcalock process is only one of many startling developments made by Goodrich engineers in the use of rubber. Rubber, as Goodrich makes it, is a new material with which you can create new products or improve old products and processes. Goodrich rubber can be made in almost any color, shape or texture; it can flex countless times; it can resist heat, cold, acids, abrasion, and time itself. This *new* rubber by Goodrich offers new sales appeals, new savings, new technical improvements to thousands of companies. Who will investigate first in your industry—you, or a competitor? The B. F. Goodrich Co., Mechanical Rubber Goods Division, Akron, Ohio.



• The Goodrich process of attaching rubber to metal or fabric made possible the Goodrich De-Icer—a rubber tube along leading edges of airplane wings and struts. It flexes, and breaks off ice as fast as it forms.

• Acid fumes have to be drawn off pickling tanks in steel mills for the protection of workers. These fumes used to eat out ventilating systems in short order. Now pipes, fans, stacks are lined with Goodrich rubber and last indefinitely.

• Goodrich rubber lining in layers (one of hard rubber between two layers of soft rubber) can be attached to metal, wood, etc. by the Vulcalock process. Its resistance to abrasion is 100 times that of hard or soft rubber alone.

• By use of the Vulcalock process, Goodrich Vogue Heels are made of rubber attached to a wood core. The result is the first firm rubber heel, and one that maintains its shape, wears longer, looks better, costs less to attach.

Goodrich

ALL *product problems* IN RUBBER

THAT you may have better steel, Bliss & Laughlin, Inc., now bring laboratory methods into production inspection through the use of

MAGNETIC ANALYSIS

BETTER MADE STEELS LABORATORY TESTED

This new "Flaw Detector" searches out hidden blemishes not visible to the human eye, and eliminates the possibility of heavy rejection in making your products to exacting specifications.

This inspection service is available on bar steel, screw stock and such other items as you desire, at a small differential for handling. Inquiries are invited.

Cold Drawn Bars and Shafting ● Ultra-Cut Steel ● Special Sections ● Alloy Steels

BLISS & LAUGHLIN, INC.

HARVEY, ILL. *Sales Offices in all Principal Cities* BUFFALO, N.Y.

6166); 11 distribution type transformers with accessories for Norfolk, Va. (Schedule 6186); until Oct. 25, four motor-driven drill presses for Washington yard (Schedule 6234); smoke indicators for boilers and spare parts (Schedule 6135), wire rope and seizing strand (Schedule 6150), resistance wire (Schedule 6152); until Oct. 29, hose fittings (Schedule 6220), for Eastern and Western yards.

MIDDLE WEST

Diamond-T Motor Car Co., 4517 West Twenty-sixth Street, Chicago, manufacturer of motor trucks and parts, has let general contract to Callner Construction Co., 33 North LaSalle Street, for one-story addition for storage and distribution. Cost about $40,000 with equipment. Armstrong, Furst & Tilton, 11 South LaSalle Street, are architects.

Glidden Co., Soya Products Division, 1845 North Laramie Avenue, Chicago, a division of Glidden Co., Cleveland, plans rebuilding six-story soy bean processing plant recently destroyed by fire. Loss over $600,000 including equipment.

City Council, Perry, Iowa, asks bids until Oct. 21 for Diesel engine-generator unit, exciter and auxiliary equipment for municipal electric power plant.

Superintendent of Construction, United States Indian Service, Billings, Mont., asks bids until Oct. 22 for one pumping unit with auxiliary equipment for water supply at Gettysburg, S. D.

Liquid Carbonic Co., 3100 South Kedzie Avenue, Chicago, manufacturer of bottling and carbonating machinery and parts, has filed plans for one-story addition, 120 x 500 ft., for which general contract recently was let to Kaiser-Ducett Co., 80 East Jackson Boulevard. It will be equipped largely as a machine works. Cost over $100,000 with equipment.

Cutler-Hammer, Inc., Milwaukee, manufacturer of electric controlling devices, has placed contracts for construction of an enameling shop costing about $30,000 with equipment.

Sheboygan Iron & Metal Co., 1230 Herman Court, Sheboygan, Wis., has plans by Edward A. Juul, local architect, for new industrial building, 50 x 150 ft., part two stories. Investment will total about $45,000.

Calumet County, Wis., Roland Miller, Chilton, County clerk, is asking bids for new highway garage and workshop, 70 x 200 ft., designed by W. C. Weeks, architect, Sheboygan, Wis., to cost about $64,200.

Board of Vocational Education, West Allis, Wis., is ready for bids on $60,000 addition to vocational school, 36 x 65 ft., two stories. Robert A. Messmer & Brother, 231 West Wisconsin Avenue, Milwaukee, are architects.

United States Engineer Office, 408 Federal Building, Milwaukee, closes bids Oct. 25 for constructing one new steel hull and house for 4½-cu. yd. dipper dredge Kewaunee; transfer machinery and equipment of old dredge Kewaunee and furnish new equipment as required (Circular 36-67, Milwaukee).

Milwaukee Sewerage Commission, James L. Ferebee, Milwaukee, chief engineer, has received approval of PWA grant for additions and improvements at municipal sewage purification plant, costing $500,000.

SOUTH CENTRAL

Director of Purchases, Tennessee Valley Authority, Knoxville, Tenn., asks bids until Oct. 28 for designing, fabricating and furnishing one lift beam and bell complete for service in conjunction with 270-ton gantry crane at Wheeler hydroelectric power plant; until Oct. 30 for 75-ton electric traveling crane for same power plant.

Clarksville Canning Co., Clarksville, Tenn., plans new food products canning plant at Portland, Tenn., including power house and other units. Cost close to $60,000 with equipment.

Mackie Products Co., Covington, La., manufacturer of rosin and other naval store products, plans rebuilding part of plant recently destroyed by fire. Loss over $100,000 with equipment.

City Council, Biloxi, Miss., is considering installation of a municipal electric light and power system, including transmission and distributing lines, and power substation facilities. Cost over $500,000. Lide & Adler, Birmingham, are consulting engineers.

PACIFIC COAST

City Council, Lodi, Cal., plans early call for bids for new municipal hydroelectric power plant on Mokelumne River, about 27 miles from city, including construction of transmission line to city, with power switching and substation facilities. Fund of $600,000 has been arranged. Clinton Henning is city engineer, in charge.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Oct. 25 for five electric ovens for San Pedro, Los Angeles, Naval Station (Schedule 6181); one motor-driven turret boring mill (Schedule 6178); until Oct. 29, one motor-driven precision lathe (Schedule 6210), eight to 20 motor-generators, four to six motor generator equipments (Schedule 6192), for Mare Island Navy Yard.

Board of Education, City and County of San Francisco, Second Avenue and East Tenth Street, San Francisco, has plans for three-story machine shop for vocational training at George Washington School. Cost over $75,000 with equipment. Miller & Pflueger, 580 Market Street, are architects.

Bureau of Yards and Docks, Navy Department, Washington, asks bids (no closing date stated) for two 3-ton gantry type cranes operated by Diesel engines for Mare Island Navy Yard (Specification 7983).

State Board of Education, Olympia, Wash., will ask bids soon on general contract for new vocational shop in connection with addition to State normal school at Ellensburg, Wash. Cost about $100,000. John Maloney, Larson Building, Yakima, Wash., is architect.

WIDE RANGE OF HEAD SIZES MADE BY BETHLEHEM SHOP

Full Equipment Produces "In-Between" Diameters as Readily as Standard Sizes

Big, little, and in-between, the range of head sizes which can be produced by the Bethlehem Flange Shop is a wide one—and it can make heads of fractional diameters as readily, and as quickly, as those of standard diameters.

This thoroughly-equipped shop has spinning machines which can produce flanged or flanged-and-dished heads in any diameter between 12 in. and 12 ft., and in any thickness from No. 12 gauge to 4 in., inclusive. On these machines, heads of "in-between" diameters, differing lengths of flange, or special knuckle radii can be produced without extended delays for machine set-up, and without the necessity of making special dies.

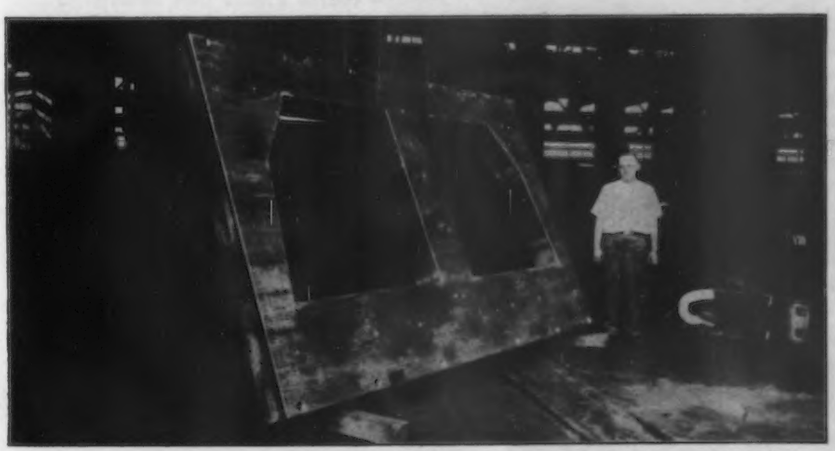
In addition to the spinning machines, the flange shop is equipped with mechanical and hydraulic presses, on which hot- or cold-pressed heads can be shaped in a wide range of sizes. Complete facilities are available for trimming, facing and finishing all flanged products.

Bethlehem's flange shop is next door to the plate mill, with open-hearth furnaces, even blast furnaces, right at hand. To the buyer of flanged products that means two fundamental advantages:

(1) Every step in the production of Bethlehem Flanged Products is under one control, one responsibility.

(2) Quick shipment can be made of flanged heads, manhole saddles and covers and the miscellaneous and special flanged plate work that is so often needed quickly.

30,000-LB. PLATE



One of the heaviest plates ever rolled. This riser plate, made by Bethlehem, is 10 in. thick, 126 in. long and 84 in. wide. The weight as rolled, 30,700 lbs., was reduced in cutting to pattern to 16,160 lbs. The plate is used to back up and give weight to an automobile-door forming die.

FLANGING MACHINE

Breaking-down operation on a small flanging machine in the Bethlehem Flange Shop. The head is being turned against the roll.

RAILROAD SHOP MAN PICKS BETHLEHEM PLATES

"Worked Fine," He Says of Nickel-Steel Plate Used in Boiler Shell

One of the boiler-shell plates in a locomotive developed defects, and was replaced with a nickel-steel plate ordered from Bethlehem Steel Company.

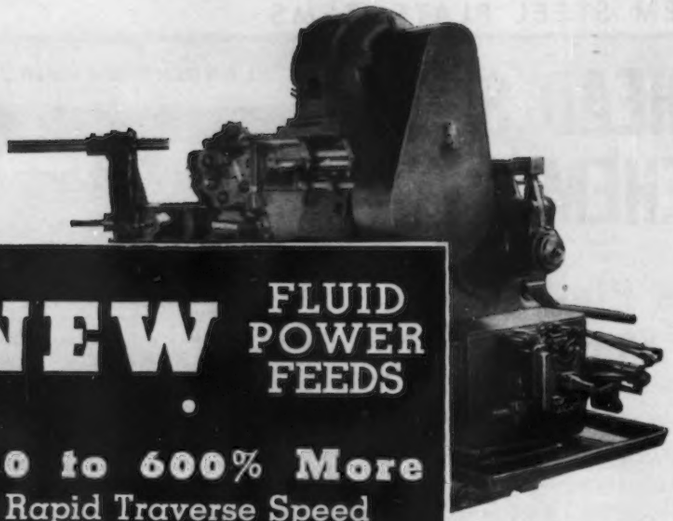
The purchasing agent of the railroad placed this trial order for a Bethlehem Nickel-Steel Plate not only with the aim of improving performance but also in the expectation of getting plate of better working qualities that would put an end to difficulties experienced in the shop with the plate formerly used.

Bethlehem rolled the plate, 1 in. thick, 119½ in. wide and 320 in. long, and it was installed as the third barrel course on the locomotive. The shop superintendent reported:

"This plate worked fine. We had none of the trouble we encountered in handling our former plates. I am going to talk this over with our purchasing agent and get him to specify Bethlehem Nickel-Steel Plates for all future jobs."

BETHLEHEM STEEL COMPANY

GENERAL OFFICES: BETHLEHEM, PA.



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Up to 50% Lower Cost

Compensated
For Speed Variations Under Temperature and Working Conditions

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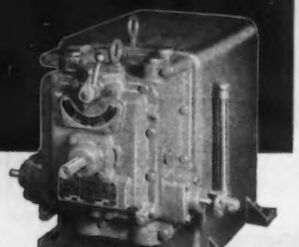
Builders and buyers hail these vastly improved machines as the way to step up sales and step down costs. The big new Oilgear Booklet gives all the facts — have you asked for yours yet? The Oilgear Company, 1311 West Bruce Street, Milwaukee, Wisconsin



● *Above:* The Foster Fastermatic No. F-4, Oilgear Fluid Power Feed equipped. Makes three parts per hour — best previous time was five per day.

● *At Right:* A new Oilgear Fluid Power Feed. Note: Flanged mounting, as integral machine part . . . Inside pump eliminating hazard and bettering appearance . . . Self-contained; auxiliary valves, tubing, etc. are integral with pump . . . Many other exclusive features.

OILGEAR FLUID POWER FEEDS
(B-1302)

Grain Size and Its Influence On the Manufacture of Steel Wire

(CONTINUED FROM PAGE 27)

Thin plates of cementite, because of their relative ductility, will deform readily while thick cementite plates will offer resistance. Areas of pearlite wherein the plates are parallel to the axis will offer less resistance than areas in which the plates are perpendicular to the axis. However, areas of fine pearlite, which consist of thin plates, will not offer serious resistance regardless of their position in relation to the axis, while areas of coarse pearlite in which the plates of cementite are perpendicular to the axis have great resistance.

In the manufacture of steel wire the patenting operation is employed to develop the microstructure from which the wire is drawn. Complete solution of the constituents is important in any heat treatment in which recrystallization is being sought. This is particularly true of patenting because of the relatively short time allotted. High temperatures accelerate solution, the rate of which depends to a great extent on the particle size of the constituents. Because of the small section of steel being treated solution may take place well above the phase boundary temperature of Ac_3 or Ac_{em} (see Fig. 1), the exact position varying with the diameter of the steel, the temperature employed and the particle size of the ferrite and cementite. Under the proper conditions of heating and with the use of steel of good quality, solution can be effected. But if coarse particles are present in the steel, or if the temperature is too low, it is possible to complete the patenting treatment without effecting complete solution. Unless solution is complete the grains will not grow and the structure developed will produce inferior wire.

The use of high temperature lowers the position of the Ar 1. The coarse grains that develop as a result of its use contribute further to this lowering, resulting in an added tendency toward the formation of fine pearlite. The use of a coarse grain steel, as determined by the McQuaid-Ehn test, helps to promote a coarse grain patented structure in view of the fact that the patenting temperature is above the grain coarsening temperature. Fine grain steels are not desirable because the patenting temperature is either below their grain coarsening temperature or in the range in which non-uniformity of grain size develops, the result being the formation of fine grains with a fast reaction rate which tends toward the formation of free ferrite and coarse pearlite. If, because of the small diameter of the wire, or due to too high temperature, the Ar 1 is lowered to a temperature around 600 deg. F., martensite will be formed.

A coarse grain steel, patented at

HELE-SHAW *Fluid* POWER

A NEW CONCEPTION OF FLEXIBILITY IN MACHINE DRIVES

VARIABLE PLANER FEED

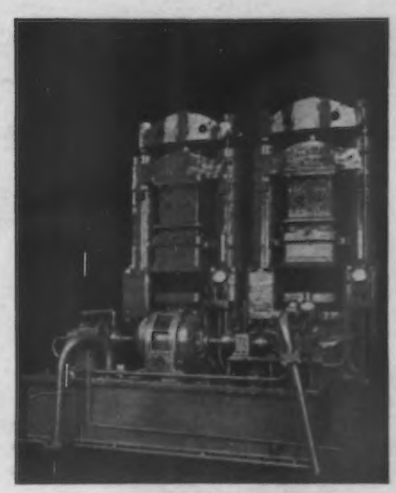
The rate at which the table can be fed depends on the depth of the cut taken. The Harry Bernstein Cut Stone Company, Inc., Brooklyn, N. Y., uses the Fluid Power of a Type C Hele-Shaw Transmission.

The transmission on the floor at the left in the picture below is a complete, self-contained unit.

The hydraulic pump and motor ends of the transmission and the direct connected electric motor are mounted on the oil reservoir which serves as a convenient base. Any feed from almost zero to maximum is possible.

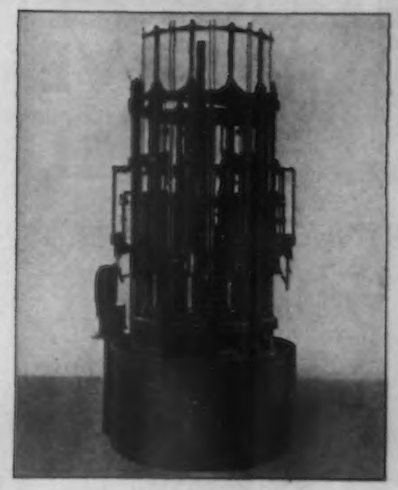
PRESSURE FOR SOLID CO_2

Presses as a class are the largest users of Fluid Power. Here, oil in a smooth, high pressure stream, delivered by the Hele-Shaw Pump, is applied by Southwark to presses for squeezing "dry ice" into salable blocks. The uses for Fluid Power in plunger or ram-type machines are boundless.



OIL FOR QUENCH HARDENING

The Gogan 12-station Hardening Machine below hydraulically straightens, end sizes and quench hardens coil springs. A Hele-Shaw Pump forces oil through the twelve revolving fountains and ends and centers of springs.



20 TO 1 STOKER SPEED RANGE

Stokers are capable of operating efficiently over a wide range of burning rates—from a banked condition to several hundred percent of rating or at any intermediate speed depending on the demand for steam. Full advantage of the possibilities of a stoker can only be taken through the use of a drive of equal flexibility. The Type S Fluid Power Transmission (hydraulic motor end only shown) provides a speed range of 20 to 1 at the West Philadelphia Steam Heating Plant of the Pennsylvania Railroad. The hydraulic pump end is located at a convenient point out of the way.

YOUR APPLICATION

Possibly you have an application for Hele-Shaw Fluid Power involving infinitely variable, reversible linear or rotary motion not pictured on this page. As this is more than likely the case, we suggest that you write to us. The services of experienced engineers are necessary for determining the applicability of Fluid Power and our engineers are at your disposal.

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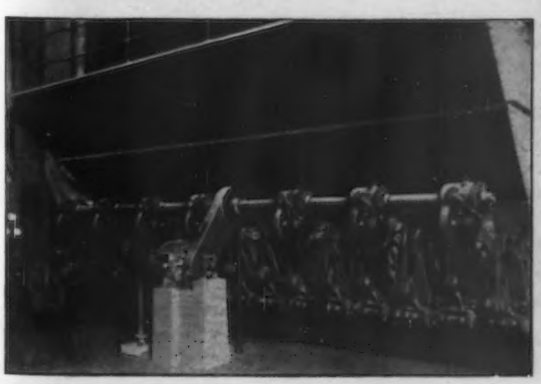

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WORTHINGTON

1850 deg. F., has a coarse grain patented structure, and a fine grain steel patented at the same temperature is composed of fine grains with some extremely coarse grains. Photomicrographs of these steels show an absence of coarse pearlite in the coarse grain steel as compared with fine grain steel, and there is also a greater amount of ferrite separated out in the fine grain steel.

In discussing microstructures, the term troostite and sorbite have been ignored because there is some question regarding their presence in steels cooled from above the critical point. Lucas has shown that by the use of high magnifications the nodular structure often found in quenched steels, commonly termed troostite, can be resolved into fine pearlite. This indicates a tendency toward stratification on cooling from above the critical range and the question has been raised[11] as to the existence of troostite or sorbite as primary constituents.

While it seems desirable to use coarse grain steel, as determined by the McQuaid-Ehn grain size test, it is possible to produce good wire from fine grain steel. Regardless of the grain size, however, it is essential that the constituents be completely dissolved in patenting, or poor quality wire will be produced. It is therefore important that the quality of the steel, with respect to dissolved oxides, be given serious consideration. In the manufacture of wire in which high tensile and high ductility must be combined, coarse grain steels, as determined by the McQuaid-Ehn test, should be employed.

Conclusions

The McQuaid-Ehn grain size test may be used as a guide, both in the melting of basic open-hearth steel and in the selection of steel for wire-drawing purposes.

The normality of steel as indicated by this test, when considered in connection with steel to which no aluminum has been added to control grain size, is an indication of the amount of dissolved oxides in the metal. Steel high in dissolved oxides may, due to increased solubility of the cementite in ferrite, develop massive cementite and ferrite on cooling.

A careful study of the charge, melt-down carbon, rate of carbon drop and slag condition is essential to the manufacture of suitable steel for the wire mill. The deoxidation of the metal is also an important step in steel making.

The control of grain size in fine grain steel can be accomplished by the use of aluminum in the ladle or mold. The steel being treated should first be deoxidized to avoid the formation of an excessive amount of Al_2O_3 particles. The control of coarse grain steel is not thoroughly understood, but depends to a great extent on the steel-making practice.

Hot or cold work does not seriously influence the size of the austenitic grains, as determined by the McQuaid-Ehn test.

The temperature at which the austenitic grains coarsen is important in the development of the patented grain size. So far as determined at present, a small amount of reduction in drawing seems to lower the grain coarsening temperature while heavy reductions seem to raise it.

Coarse grain steels have a slow reaction rate and fine grain steels have a fast reaction rate. The rate of reaction has an influence on the fineness of the pearlite developed as a result of patenting.

Dissolved oxides and fine grains may, by the development of large particles, influence the rate at which the constituents go into solution.

To produce wire of high quality it is important that the cold work be evenly distributed throughout the cross-section. The distribution of cold work depends on the microstructure of the steel being drawn.

The patenting operation is a prime factor because it is the means by which the microstructure of the steel to be drawn is developed.

The difference in the reaction rates of coarse and fine grain steel is also noticeable in coarse and fine grain patented structures. Coarse grain patented structures tend to produce finer pearlite and less ferrite in the hypo-eutectoid steel than fine grain patented structures.

It seems desirable to employ coarse grain steel for the manufacture of high-carbon wire because of the coarse patented grain size that results from its use.

Troostite, sorbite or sorbite-pearlite are not duscussed because their presence in the patented structure is questionable.

[11] Metal Progress, Volume XXVII, No. 2, August, 1935.

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In our manufacture of cap screws and set screws we have earned a reputation for highest quality in our products—a reputation we guard jealously by every means at our command. The right steel, the proper inspections during production, and finally, the right kind of a package so that our products reach you in good condition—these you take for granted. But examine any shipment of Cleveland Cap Screws. Flat heads, fillister heads, hexagon heads—all are full finished and accurate in every detail. These flat heads shown are fine machine parts—but taken at random out of our stock. Order from your Distributor, our nearest warehouse or the factory.

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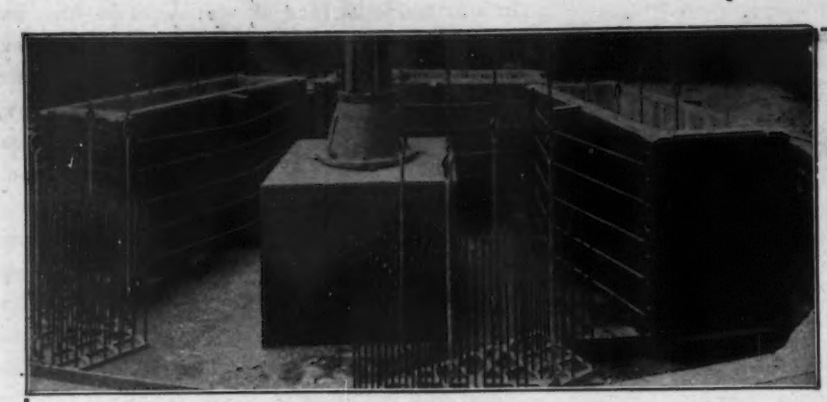

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Because only the most carefully selected material and experienced workmanship go into their construction.

G. WOOLFORD WOOD TANK MFG. CO. (FACTORY DARBY, PA.) **Paschall P. O., Phila., Pa.**

Aluminum in Modern Commercial Steel

(CONTINUED FROM PAGE 34)

from the carburizing agent, and with these steels it has been found advantageous to carburize at temperatures 50 to 100 deg. F. higher than would be considered proper for steels not containing vanadium.

One of the largest users of vanadium carburizing steel carburizes regularly at a temperature of 1775 deg F. with very satisfactory results. The object of the higher carburizing temperature is to increase the solubility of the carbon in the austenite and to thereby prevent the building up of carbide at the surface in a form which is difficultly soluble at the carburizing temperatures. It also indicates that the austenite grain size established as we pass through the critical range will tend to be fixed by the presence of difficultly soluble carbides which exist at the grain boundaries in the saturated outer zone. The presence of any substance (such as aluminum) in the austenite which would tend to decrease the solubility of the carbon or carbide in the austenite would tend to favor the formation at the lower carburizing temperatures of excess carbides around the austenite grain boundaries in the saturated zone.

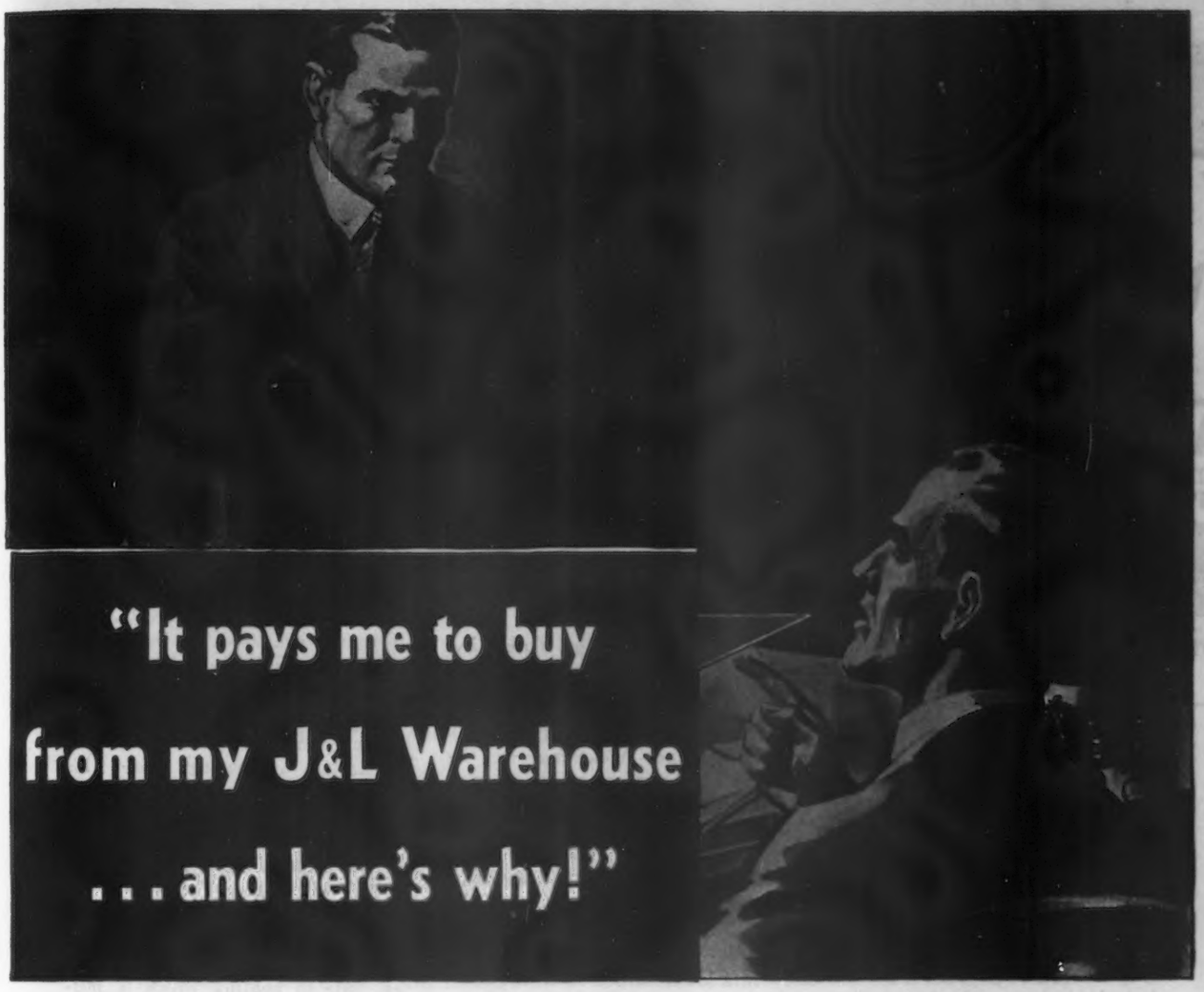
These carbide particles would tend to coalesce and become still more difficultly soluble and hence it is not at all impossible that under the usual conditions of carburizing that we have the building up of carbides in the boundaries of the saturated austenite grains at the lower carburizing temperatures which tend to restrict grain growth until we reach a temperature at which the solubility of carbon in the austenite has increased to the point where the carbide particles around the austenite grain boundaries will be absorbed.

We are all familiar with the tendency in quenched coarse grained chrome steels of the carburizing grade to exhibit, when fractured, a fine martensitic hypereutectoid zone and a coarse martensitic gradation zone, indicating the inhibiting action of the difficultly soluble chrome carbides in the hypereutectoid zone.

An indication of the effect of carbide which resists solution is found not only in the case of vanadium steels, but also in most steels as far as is known, which are being carburized in an active carburizer. This indication is found in the fact that as a rule the hypereutectoid zone in a carburized piece resists grain growth to a higher temperature than the gradation zone or core. While many grain growth carburizing tests have been made, I have yet to see one plain carbon heat or vanadium steel heat where the core coarsened at a higher temperature than the case. Almost invariably the core would coarsen at a temperature from one-hundred to one-hundred-fifty-degrees fahrenheit lower than the hypereutectoid zone. Grossmann mentions cases where the hypereutectoid zone coarsens at a lower temperature than the core, but offers no explanation of the phenomenon. Certainly it is difficult to explain by the presence of submicroscopic particles of aluminum oxide. It is also difficult to explain by attributing grain growth inhibition to aluminum and its effect on austenite solubility of carbides. It might possibly be explained by the hypereutectoid zone being close to eutectoid composition, due to the use of a compound which weakens rapidly at the higher temperatures such as would be the case when straight sodium carbonate energizer is used.

The temperature and rate at which the carbide particles will be absorbed depends principally upon their size, composition and the presence in the austenite of some element which tends to affect their solubility. Upon cooling, if the austenite transformation takes place at a high enough temperature so that carbides are precipitated while the ferrite is sufficiently mobile to permit coalescence at a time when the transformation is slow enough, either lameller pearlite or spherodized carbide and ferrite or an intermediate stage of partly diffused (coalesced) carbide may be the result. Lameller pearlite results when the carbide is precipitated at such a rate or in a mobile enough ferrite so that coalescence starts in the form of plates from many points in the pearlite grain. If the transformation is at such a temperature and rate that the carbide not only has time to form plates but to coalesce further, the carbides will, in a hypereutectoid steel, coalesce on the boundary carbides those plates in contact with the boundary carbides, leaving the center of the pearlite grain lameller and forming the familiar abnormal rim.

In other words, the so-called abnormal type of structure is due to coalescence of the carbide plates



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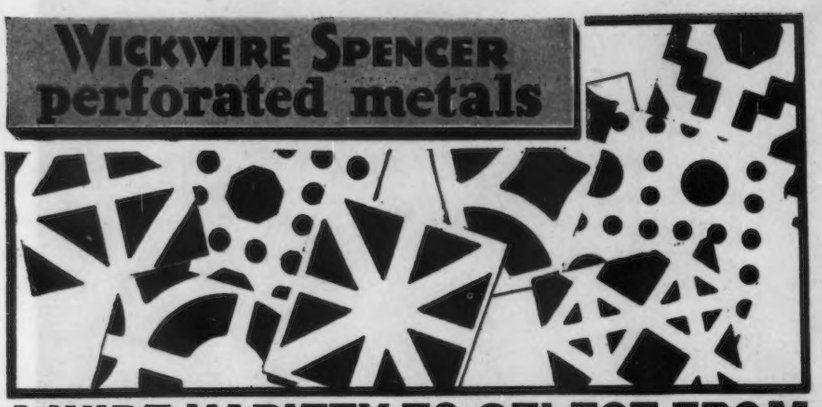

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in contact with the boundary carbide under conditions of time and temperature of the ferrite which will permit it. The tendency of the carbide plates in contact with the boundary carbides to coalesce and leave a ferrite rim would vary with different heats, depending upon the speed and temperature of the transformation of the austenite, which in turn would be affected by several factors such as aluminum, iron oxide, iron sulphide, etc., in solution in the austenite.

The presence of manganese, nickel, etc., which would tend to stabilize the austenite would reduce the tendency to coalesce the carbide, due to the greater rigidity of the ferrite at the lower temperature of transformation. Thus the higher manganese steels would tend to be more normal than the lower manganese steels. For the same reason it is evident that any carburized steel having a hypereutectoid zone would, upon sufficiently slow cooling, develop an abnormal structure as shown by Dr. Grossmann in his Campbell Memorial Lecture. It is believed that this building up of the carbide plates which touch the boundary carbide, will be greater or less, depending upon the rate of rejection of the carbine from the ferrite and the rigidity of the ferrite. If the rate of rejection is slow enough and the ferrite temperature high enough, coalescence will start at many points in the pearlitic grain, the lamellae thickening to the point finally where we have complete spherodization. It is easy to see that we may have various points of carbide coalescence in a slow cooled steel and that this coalescence depends primarily on the mobility of the ferrite and the rate of rejection of the carbide.

In a lower carbon steel, the coalescence of the carbides on the boundary would naturally be absent, and as before would occur finally within the pearlitic grain to form spherodized carbide. It is possible that aluminum in solution in the austenite increases the speed of carbide rejection and decreases the carbide solubility in the ferrite. At the same time it would increase the speed and temperature of the austenite transformation, a phenomenon which has been observed to be characteristic of the abnormal steel, and accounts for the more shallow hardening of this type of steel.

The greater tendency for the carbides to coalesce in steels to which aluminum has been added as evidenced by the abnormal strucure, does not indicate at first glance the logical explanation of the relation of grain size to the coalescence of the carbide. On heating, however, it is believed that the aluminum in solution in the austenite will delay the austenite transformation, and due to the tendency of the carbides to exist in these steels in the more coalesced form, the carbides will be more difficult to dissolve. It is quite possible that there is a considerable tendency for the carbides in the steels containing aluminum to coalesce in the ferrite at temperatures just before the transformation to austenite. This would be the reverse phenomena from that met with in cooling and would develop carbides not only difficult to get into solution, but which would act as inhibitors to grain growth until a temperature had been reached in which they became readily soluble in the austenite.

Herty has shown that the rate of heating through the transformation range has a pronounced effect on the recrystallization rate of silicon killed plain carbon steels. Very little grain refinement occurs when heating rates faster than 9 deg.F. per min. are used, but below this rate grain refinement *increases* as the rate of heating *decreases*.

Aluminum killed steels show strongly marked grain refinement regardless of heating rate. This important phenomenon can be explained by the increasing coalescence of the carbide in the ferrite, of the silicon killed steel, which occurs with increase in time at the temperature of the transformation. With the aluminum killed steel, the coalescence occurs even at the fastest rate of heating which is possible.

It should be remembered at this point that the austenite transformation rate, both on heating and cooling is affected by the presence of carbides, non-metallic inclusions, mechanical stresses, etc., so that the grain growth inhibting action of the carbides out of solution is also affected by these factors. Thus we may have in steels which are mechanically worked within the critical range, or just above the critical range, stresses in individual grains or groups of grains which facilitate the solution of carbides and thereby tend to form coarse grains in an otherwise fine grain structure. This produces the so-called duplex structure which is directly connected with mechanical workings. The presence of oxides and probably nitrides, etc. would have the effect of decreasing the carbide solubility and hence also acting as grain growth inhibitor.

The tendency of the aluminum addition to cause heavier carbide

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particles in the ferrite would require, of course, a more rapid cooling in order to obtain the finer carbide distribution necessary to produce martensitic or fine pearlitic structure. The tendency to coalesce the carbides and form thereby a scarser pearlitic structure would be overcome by such additions as manganese and nickel which would lower the austenite transformation rate to the point where the rigidity of the ferrite interferes with the carbide coalescence. Thus it would be possible, by the addition of manganese, to obtain with ordinary quenching the necessary hardness in a steel containing aluminum. On heating this steel, however, coalescence would take place at the temperature of transformation and the heavier carbide particles, would, as before, tend to inhibit grain growth so that with the high manganese steels we get the benefit of the deeper hardening properties and at the same time the fine grain structures which are characteristic of the steels containing aluminum.

The addition of any of the deeper hardening elements to steel containing aluminum would produce a result similar to that of manganese, so that the benefits of the aluminum addition to the alloy steels would still be worth while.

It is interesting to consider here the opinion of Professor Edward DeMille Campbell on the subject which we have just discussed. In a letter to him in 1921 in which he discussed the subject of carbide stability in the so-called "abnormal" type of steel, Professor Campbell expresses himself as follows:

"In normal steel above the critical point the carbides form a homogeneous, probably colloidal solution, which persists until the critical point is reached, when, as the gamma iron goes over the alpha state, in which the carbides are but slightly soluble, the precipitated carbides assume the form of thin plates, characteristic of normal pearlite. It is well known that the addition of a comparatively small amount of an electrolyte to any colloidal solution in water will bring about coagulation or flocculation of the colloid, and I think it not improbable that the dissolved oxides in your abnormal steels function in a manner exactly analogous to that of electrolytes in aqueous solutions, thus bringing about the flocculation or coalescence of the carbides, either before transformation takes place or during the critical period."

It is not intended to claim at this time that the grain growth characteristics, the hardenability characteristics or the abnormality characteristics are due to either the presence of submicroscopic alumina particles or to the effect of aluminum on the austenite transformation rate and rate of carbide rejection. The explanation that aluminum influences the hardenability and grain growth characteristics by its effect on the coalescence of the carbides precipitated when the austenite transforms is simply offered as a theory which seems to have a somewhat more closer agreement to practice than would seem to be the case if we tried to explain these phenomena on the basis of sub-miscroscopic alumina dispersion.

It is offered simply as a suggestion and only as a theory in the hope that it might lead to a more general discussion and investigation of the behavior of aluminum when added in relatively small quantities to the commercial heats of steel.

In conclusion, it might be well to stress a little, the fact that steel making is after all still an art, and that we must turn over to a few well-trained men the problem of reducing a mixture of more than one-hundred tons of miscellaneous (but selected) scrap, pig, limestone, etc. to a condition where it represents a valuable and usable high quality product, checked and inspected on every hand and which must not only meet close chemical specifications, but must harden deep enough but not too deep; must not warp too much, or crack in quenching, must machine well, must pass microscopic and macroscopic cleanliness tests, must pass so-called impact tests, transverse tests, grain size tests, etc., etc., etc.

This modern miracle must be accomplished under the most difficult of working conditions at temperatures close to 3000 deg. F., at which the very furnace itself is being destroyed in the making of the steel, a temperature at which the refractories used in ladle and runner are short lived, and at which reactions proceed at incredible speeds, particularly those involving oxidation. Yet under these adverse conditions, and with all the care involved in the selection of the personnel, equipment and materials, the success or failure of the result depends on being able to control the physical condition in the steel as it solidifies, of the addition to the steel of up to one part in one thousand of the most active of all the metallic elements that we know of, i. e., aluminum.

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JUST BETWEEN US TWO

Zenith

OUR annual award for the highest mark in cockiness goes to the Chicago renter of gents' evening clothes whose sign near the Indiana Ave. L station reads, "Marshall Fields are opposite us."

Rara Avis

GUARD your copy of the Machine Tool Show Number (Sept. 5th issue). The demand for this 384-page beauty has swamped us. Specimen comment—this one from the superintendent of one of the industry's blue ribbon plants:

> *"It is the finest issue of any publication I have ever gone over. If possible, I should very much like to get six copies to give to men of our shop organization to serve as a text book on modern equipment."*

And not a copy is left on our shelves.

Lip Courtesy

"PLEASE" and "thank you" are all right in their place, but managers of the high-priced hostelries are making these pleasant little social lubricants ridiculous and meaningless by insisting that the help tack them on to every remark.

The announcement that the hotel elevator has reached your floor is entirely adequate. Adding on the word "please" is, to steal a simile from Fulton Oursler, as out of place as a whiskey label on a baby's nursing bottle.

People who are forced by house regulations to be unnaturally polite to paying guests must have to curse their wives and horsewhip their children in order to maintain a mental balance.

We hope Mr. Hitz, Mr. Statler and Mr. Stevens and friends will inculcate easy graciousness in the help and fire anyone who injects a "please" or "thank you" where it sticks out like a pillbox in an osteopath's office.

Prosperity Note

THE morale of the country has now improved to such a degree that the eminently cautious Saturday Evening Post believes it safe to print a story with an unhappy ending. For once she didn't get her man, but we'll gamble that someone got you know what from Mr. Lorimer.

(Note: Instead of the clumsy "you know what" we would like to say "hell" right out, but we learned indirectly that one of the fifteen readers of this column is a member of the board of trustees or something of a certain church, and was displeased when profanity reared its ugly head here once before. So we have to be careful or there will only be fourteen.)

Our Face Is Red

APOLOGIES to Messrs. Irwin, Cochran, Thum, Wm. L. Oakes Machinery Co., Rosenberg and others for deluding them into believing a 20 ft. ladder and a 30 ft. ladder could be made to cross 15 ft. above an alley (p. 211 of Sept. 26 Iron Age).

We hope the pig and hog feed man has the grace to hang his head in shame and that he will relieve our embarrassment by resubmitting the problem with the correct figures.

Endurance Contest Ends

"IT looks," writes an Ohio wood-working Machinery builder, "as though we cannot get along without The Iron Age for a longer period. Begin at once to send it again."

Success

WE were highly pleased with ourselves that it took us only from Buffalo to South Bend, on a medium fast train, to solve this bridge problem, printed we forget where:

North
S: 5
H: 7
D: A 5 4
C: K 8

West
S: A Q 4
H: Blank
D: K
C: J 10 9

East
S: Blank
H: 5 2
D: J 10 8 3
C: 5

South
S: K
H: Q
D: Q 9 7 6 2
C: Blank

Diamonds are trumps. South leads. North and South to take six tricks.

Help

WE crave to know who makes an alloy called Argentol.

—A.H.D.

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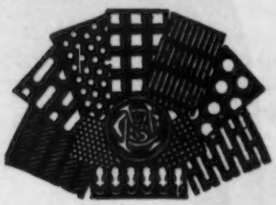

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Classified Sections

The classified sections of The Iron Age are a frequent means of contact for all kinds of services. ¶ Somebody wants to locate a company to make certain parts or machines for him, and turns to the Contract Manufacturing Section. ¶ Somebody else is looking for a bargain in used equipment, and turns to the Clearing House Section. ¶ Another is watching for Business Opportunities, and keeps his eye on that section. ¶ Then, of course, there is the active Employment Section where men and positions get together. ¶ See the pages following the Products Index.